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# LABORATORY EVALUATIONS OF COMPOUNDS AS REPELLENTS TO COCKROACHES, 1953-1974

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# LABORATORY EVALUATIONS OF COMPOUNDS AS REPELLENTS TO COCKROACHES, 1953-1974

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In 1953 the search for cockroach repellents was undertaken at Beltsville, Md. The candidate compounds were either prepared by chemists of the former Entomology Research Division at Beltsville or obtained from commercial suppliers, especially S. C. Johnson and Son, Inc. This report contains 901 compounds that were evaluated biologically; 872 were synthetics and the remainder botanical extracts.

## METHOD

To determine the repellency of a compound, a modification of the method of Goodhue and Tissol (6)<sup>3</sup> was used. Ten male and ten female adult cockroaches were placed without food or water in a 19- by 10-cm glass crystallizing dish. The inner lip of the dish was coated with a thin layer of paraffin oil to prevent the insects' escape. The cockroaches were offered a choice of two shelters, one of which was treated with the candidate compound. The type of shelter depended on the size of the insect. A notched, soft cardboard box, 6.35 cm square by 2.9 cm deep, was used for the German cockroach (*Blattella germanica* (L.)) and the brownbanded cockroach (*Supella longipalpa* (F.)). An unwaxed, lidless, 1/2-pint cylindrical ice cream container with two entrance notches was used for the American cockroach (*Periplaneta americana* (L.)) and the oriental cockroach (*Blatta orientalis* L.).

The shelters were treated immediately before the test by pipetting a 1-percent solution of

the compounds in acetone on the entire inner surface. One ml was used in the small boxes ( $82 \text{ cm}^2$ ) and 2 ml in the ice cream cartons ( $150 \text{ cm}^2$ ). When the acetone had completely evaporated, a treated and an untreated shelter were placed in the crystallizing dish with the cockroaches. With each series of tests since 1956, fencholic acid was used as a standard.

The tests were always started on Monday, and the cockroaches were counted daily except Sunday for 1 week. With as little disturbance to the insects as possible, a count was made by observing through the bottom of the crystallizing dish. Only the insects on the inner surface of the shelters were counted. Cockroaches that had entered neither container or were merely hiding beneath the shelter were not included in the day's count. After each count the insects were shaken out of their shelters and the two shelters reversed to force the insects to make another choice. Each test was replicated 2 or 3 times resulting in a minimum of 12 counts for each test material.

Most of the compounds tested were screened first against the German cockroach. In general, only the compounds that caused 20 percent or less of the insects to enter the treated carton were screened against the American cockroach. If satisfactory results were obtained again, the compound was further tested against the oriental and brownbanded cockroaches. Some studies were limited by a shortage of compounds, insects, or time.

## RESULTS AND DISCUSSION

The results of this study are given in table 1. The compounds tested are divided into synthetics and botanicals. The chemical names are in

<sup>1</sup> Retired Oct. 25, 1975.

<sup>2</sup> Retired June 30, 1972.

<sup>3</sup> Italic numbers in parentheses refer to Literature Cited, p. 2.

accordance with "Chemical Abstracts," 8th Collective Index (1967-71).

The effectiveness of the chemicals under test is expressed in the percent of the insects that entered the treated carton. Since a treated and an untreated carton were used in each test, 50 percent would indicate that the treated carton was completely ineffective and that the insects had divided equally in the two cartons. The percentages in the table can be converted to percent repellency by multiplying them by 2 and subtracting from 100. For example, if 3 percent of the insects entered a treated carton, the test material would be 94 percent effective as a repellent ( $100 - (2 \times 3) = 94$ ).

Of the 901 compounds tested, 127 repelled 94 percent or more of the German cockroaches, 61 repelled 100 percent of this species, and 13 repelled 100 percent of all four species tested. These outstanding materials are items 70, 165, 506, 516, 549, 551, 552, 678, 718, 727, 728, 750, and 845 in table 1.

No attempt is made here to correlate the biological results with chemical structure. However, some of the chemicals listed have been correlated previously (7, 8, 11, 12). Although not based on biological data obtained at Beltsville, chemical structure has been correlated with biological results by McGovern et al. (9 and 10).

Mortality counts were made in connection with the daily repellent counts, but in most cases were not higher than would be expected from natural causes. No attempt was made to determine whether the better repellents were toxicants at higher concentrations. The repellency of known toxicants to cockroaches has been reported by Burden (1), Ebeling et al. (2-5), and Smittle et al. (13).

## LITERATURE CITED

- (1) BURDEN, G. S. 1975. REPELLANCY OF SELECTED INSECTICIDES. Pest Control 43 (6): 16, 18.
- (2) EBELING, W., REIERSON, D. A., and WAGNER, R. E. 1967. INFLUENCE OF REPELLENCY ON THE EFFI-  
CACY OF BLATTICIDES. II. LABORATORY EX-  
PERIMENTS WITH GERMAN COCKROACHES. Jour. Econ. Ent. 60: 1375-1390.
- (3) ——— 1968. INFLUENCE OF REPELLENCY ON THE EFFI-  
CACY OF BLATTICIDES. III. FIELD EXPERI-  
MENTS WITH GERMAN COCKROACHES WITH  
NOTES ON THREE OTHER SPECIES. Jour. Econ. Ent. 61: 751-761.
- (4) ——— 1968. INFLUENCE OF REPELLENCY ON THE EFFI-  
CACY OF BLATTICIDES. IV. COMPARISON OF  
FOUR COCKROACH SPECIES. Jour. Econ. Ent. 61: 1213-1219.
- (5) ——— 1966. INFLUENCE OF REPELLENCY ON THE EFFI-  
CACY OF BLATTICIDES. I. LEARNED MODI-  
FICATION OF BEHAVIOR OF THE GERMAN  
COCKROACH. Jour. Econ. Ent. 59: 1374-  
1388.
- (6) GOODHUE, L. D., and TISSOL, C. L. 1952. DETERMINING THE REPELLENT ACTION OF  
CHEMICALS TO THE AMERICAN COCKROACH.  
Jour. Econ. Ent. 45: 133-134.
- (7) McGOVERN, T. P., BODENSTEIN, O. F., FALES, J.  
H., and BEROZA, M. 1974. AMIDES OF HETEROCYCLIC AMINES: HIGHLY  
EFFECTIVE AS REPELLENTS AGAINST FOUR  
SPECIES OF COCKROACH. Jour. Econ. Ent. 67: 639-640.
- (8) ——— BODENSTEIN, O. F., FALES, J. H., and  
BEROZA, M. 1975. N,N-DISUBSTITUTED N-ALIPHATIC AMIDES AS  
REPELLENTS FOR FOUR COCKROACH SPECIES.  
Jour. Med. Ent. 12: 259-260.
- (9) ——— BURDEN, G. S., and BEROZA, M. 1975. N-ALKANESULFONAMIDES AS REPELLENTS  
FOR THE GERMAN COCKROACH. Jour. Med.  
Ent. 12: 387-389.
- (10) ——— GOUCK, H. K., BURDEN, G. S., and others. 1974. N,N-SUBSTITUTED N-ALKANESULFONAMIDES  
AS REPELLENTS FOR THE YELLOWFEVER MOS-  
QUITO AND THE GERMAN COCKROACH. Jour.  
Econ. Ent. 67: 71-73.
- (11) SCHWARTZ, M., BODENSTEIN, O. F., and FALES,  
J. H. 1970. COMPOUNDS RELATED TO CYANOACETIC ACID  
AS REPELLENTS FOR COCKROACHES. Jour.  
Econ. Ent. 63: 429-432.
- (12) ——— BODENSTEIN, O. F., and FALES, J. H. 1971. COMPOUNDS RELATED TO CYANOACETIC ACID  
AS REPELLENTS FOR COCKROACHES. II. Jour.  
Econ. Ent. 64: 576-578.
- (13) SMITTLE, B. J., BURDEN, G. S., and BANKS, W. A.  
1968. COCKROACH INSECTICIDES. HOW REPELLENT  
ARE THEY? Pest Control 36 (11): 9-10.

TABLE 1.—Comparative effectiveness of synthetic and botanical compounds evaluated as repellents against 4 cockroach species. Average of 2 tests or more of 1-week duration, consisting of 6 daily counts. Dosage of 1 ml per 82 cm<sup>2</sup> in tests against German and brownbanded cockroaches and 2 ml per 150 cm<sup>2</sup> against American and oriental cockroaches

Item	(AI3- )	Compound	Cockroaches in treated carton <sup>1</sup>			
			German	American	Oriental	Brown-banded
SYNTHETICS						
			Percent	Percent	Percent	Percent
1----21274	Acetaldehyde, 2-chloroethyl piperonyl acetal		17	50	---	---
2----23530	Acetamide, <i>N</i> -benzyl-2-chloro-		40	18	---	---
3----70274	Acetamide, <i>N</i> -1-but enyl- <i>N</i> -cyclohexyl-		10	10	---	---
4----70176	Acetamide, <i>N</i> -butyl- <i>N</i> -(1-butylpropenyl)-		15	2	---	2
5----23388	Acetamide, <i>N</i> -butyl-2-chloro-		15	6	---	---
6----23528	Acetamide, <i>N</i> -sec-butyl-2-chloro-		42	13	---	---
7----23573	Acetamide, <i>N</i> -tert-butyl-2-chloro-		46	21	---	---
8----70322	Acetamide, <i>N</i> -butyl- <i>N</i> -1-cyclohexen-1-yl-		2	2	0	2
9----70148	Acetamide, <i>N</i> -butyl- <i>N</i> -[2-(1-cyclohexen-1-yl)-1-cyclohexen-1-yl]-		33	---	---	---
10---28966	Acetamide, <i>N</i> -butyl- <i>N</i> -(3,7-dimethyl-1,6-octadienyl)-		13	27	6	0
11---70145	Acetamide, <i>N</i> -butyl- <i>N</i> -(1,4-dimethyl-1-pentenyl)-		2	7	---	---
12---70036	Acetamide, <i>N</i> -butyl- <i>N</i> -(1-ethoxy-3,7-dimethyl-6-octenyl)-		42	---	---	---
13---28968	Acetamide, <i>N</i> -butyl- <i>N</i> -(2-ethyl-1-hexenyl)-		1	0	1	0
14---70272	Acetamide, <i>N</i> -butyl- <i>N</i> -(2-ethylhexyl)-		0	0	---	---
15---70237	Acetamide, <i>N</i> -butyl- <i>N</i> -(2-ethyl-1-methoxyhexyl)-		3	0	---	---
16---28969	Acetamide, <i>N</i> -butyl- <i>N</i> - <i>p</i> -menth-3-en-3-yl-		0	0	1	2
17---70234	Acetamide, <i>N</i> -butyl- <i>N</i> -(1-methyl-1-hexenyl)-		6	4	---	---
18---70330	Acetamide, <i>N</i> -butyl- <i>N</i> -(3,3,5-trimethyl-1,5-cyclohexadien-1-yl)-		0	1	0	0
19---23531	Acetamide, 2-chloro- <i>N</i> -cyclohexyl-		24	2	---	---
20---23853	Acetamide, 2-chloro- <i>N,N</i> -dicyclohexyl-		56	66	---	---
21---23570	Acetamide, 2-chloro- <i>N</i> , <i>N</i> -diethyl-		32	14	---	---
22---23544	Acetamide, 2-chloro- <i>N</i> , <i>N</i> -diisobutyl-		25	2	---	---
23---23542	Acetamide, 2-chloro- <i>N</i> , <i>N</i> -diisopropyl-		19	5	---	---
24---23535	Acetamide, 2-chloro- <i>N</i> , <i>N</i> -dioctyl-		46	46	---	---
25---23551	Acetamide, 2-chloro- <i>N</i> , <i>N</i> -dipentyl-		64	36	---	---
26---23527	Acetamide, 2-chloro- <i>N</i> , <i>N</i> -dipropyl-		16	2	---	---
27---23532	Acetamide, 2-chloro- <i>N</i> -heptyl-		1	2	---	---
28---23533	Acetamide, 2-chloro- <i>N</i> -hexyl-		5	1	---	---
29---23529	Acetamide, 2-chloro- <i>N</i> -isobutyl-		28	8	---	---
30---23558	Acetamide, 2-chloro- <i>N</i> -(3-isopropoxypropyl)-		44	18	---	---
31---23574	Acetamide, 2-chloro- <i>N</i> -isopropyl-		38	42	---	---
32---23552	Acetamide, 2-chloro- <i>N</i> -(3-methoxypropyl)-		36	40	---	---
33---23565	Acetamide, 2-chloro- <i>N</i> -( $\alpha$ -methylbenzyl)-		52	36	---	---
34---23571	Acetamide, 2-chloro- <i>N</i> -1-naphthyl-		45	45	---	---
35---23537	Acetamide, 2-chloro- <i>N</i> -octyl-		4	17	---	---
36---23564	Acetamide, 2-chloro- <i>N</i> -pentyl-		15	7	---	---
37---23562	Acetamide, 2-chloro- <i>N</i> -phenethyl-		42	56	---	---
38---23390	Acetamide, 2-chloro- <i>N</i> -propyl-		19	12	---	---
39---34203	Acetamide, 2-cyano- <i>N</i> , <i>N</i> -diethyl-		28	54	---	---
40---70336	Acetamide, <i>N</i> -[2-(1-cyclohexen-1-yl)-1-cyclohexen-1-yl]- <i>N</i> -isobutyl-		18	0	0	1
41---70329	Acetamide, <i>N</i> -1-cyclohexen-1-yl- <i>N</i> -isobutyl-		3	0	0	8
42---70334	Acetamide, <i>N</i> -1-cyclohexen-1-yl- <i>N</i> -propyl-		7	0	0	0

See footnotes at end of table.

TABLE 1.—Comparative effectiveness of synthetic and botanical compounds evaluated as repellents against 4 cockroach species—Continued

Item	(AI3- )	Compound	Cockroaches in treated carton <sup>1</sup>			
			German	American	Oriental	Brown-banded
SYNTHETICS—Continued						
43---28967		Acetamide, <i>N</i> -cyclohexyl- <i>N</i> -(3,7-dimethyl-1,6-octadienyl)-	65	14	23	0
44---70141		Acetamide, <i>N</i> -cyclohexyl- <i>N</i> -(2-ethyl-1-hexenyl)-	2	23	---	---
45---16742		Acetamide, <i>N</i> -cyclohexyl- <i>N</i> -(2-ethylhexyl)-	14	14	---	---
46---70271		Acetamide, <i>N</i> -cyclohexyl- <i>N</i> -isobutyl-	0	1	---	---
47---28970		Acetamide, <i>N</i> -cyclohexyl- <i>N</i> -(2-methylpropenyl)-	12	0	0	0
48---16737		Acetamide, <i>N</i> -cyclohexyl- <i>N</i> -propyl-	1	0	---	---
49---33505		Acetamide, <i>N</i> -decyl-2-( <i>p</i> -methoxyphenoxy)-	11	76	---	---
50---23547		Acetamide, <i>N,N</i> -dibenzyl-2-chloro-	48	78	---	---
51---23543		Acetamide, <i>N,N</i> -dibutyl-2-chloro-	14	2	---	---
52---34109		Acetamide, <i>N,N</i> -dibutyl-2-[( <i>o</i> -methoxybenzyl)oxy]-	47	---	---	---
53---34051		Acetamide, <i>N,N</i> -dibutyl-2-[( <i>p</i> -methoxybenzyl)oxy]-	18	48	---	---
54---33488		Acetamide, <i>N,N</i> -dibutyl-2-( <i>o</i> -methoxyphenoxy)-	67	---	---	---
55---33489		Acetamide, <i>N,N</i> -dibutyl-2-( <i>p</i> -methoxyphenoxy)-	7	56	---	---
56---34108		Acetamide, <i>N,N</i> -diethyl-2-[( <i>o</i> -methoxybenzyl)oxy]-	48	---	---	---
57---34050		Acetamide, <i>N,N</i> -diethyl-2-[( <i>p</i> -methoxybenzyl)oxy]-	70	---	---	---
58---33484		Acetamide, <i>N,N</i> -diethyl-2-( <i>o</i> -methoxyphenoxy)-	58	---	---	---
59---33485		Acetamide, <i>N,N</i> -diethyl-2-( <i>p</i> -methoxyphenoxy)-	46	---	---	---
60---34111		Acetamide, <i>N,N</i> -diisobutyl-2-[( <i>o</i> -methoxybenzyl)oxy]-	54	---	---	---
61---34052		Acetamide, <i>N,N</i> -diisobutyl-2-[( <i>p</i> -methoxybenzyl)oxy]-	70	---	---	---
62---33492		Acetamide, <i>N,N</i> -diisobutyl-2-( <i>o</i> -methoxyphenoxy)-	67	---	---	---
63---33493		Acetamide, <i>N,N</i> -diisobutyl-2-( <i>p</i> -methoxyphenoxy)-	58	---	---	---
64---34053		Acetamide, <i>N,N</i> -diisopropyl-2-[( <i>p</i> -methoxybenzyl)oxy]-	35	---	---	---
65---33491		Acetamide, <i>N,N</i> -diisopropyl-2-( <i>p</i> -methoxyphenoxy)-	47	---	---	---
66---70409		Acetamide, <i>N</i> -(3,7-dimethyl-1,6-octadienyl)- <i>N</i> -methyl-, ( <i>E</i> )-	2	0	0	1
67---70235		Acetamide, <i>N</i> -(2-ethyl-1-hexenyl)- <i>N</i> -isobutyl-	0	6	---	---
68---70201		Acetamide, <i>N</i> -(2-ethyl-1-hexenyl)- <i>N</i> -isopropyl-	7	0	---	1
69---70236		Acetamide, <i>N</i> -(2-ethyl-1-hexenyl)- <i>N</i> -propyl-	4	4	---	---
70---70415		Acetamide, <i>N</i> -(2-ethyl-1-methoxyhexyl)- <i>N</i> -methyl-	0	0	0	0
71---70238		Acetamide, <i>N</i> -(2-ethyl-1-methoxyhexyl)- <i>N</i> -propyl-	2	4	---	---
72---33498		Acetamide, <i>N</i> -heptyl-2-( <i>o</i> -methoxyphenoxy)-	72	44	---	---
73---33499		Acetamide, <i>N</i> -heptyl-2-( <i>p</i> -methoxyphenoxy)-	46	---	---	---
74---33497		Acetamide, <i>N</i> -hexyl-2-( <i>p</i> -methoxyphenoxy)-	42	---	---	---
75---70333		Acetamide, <i>N</i> -isopropyl- <i>N</i> -( <i>o</i> -methoxybenzyl)-	12	0	2	0
76---70202		Acetamide, <i>N</i> -isopropyl- <i>N</i> -(2-methylpropenyl)-	56	---	---	---
77---70381		Acetamide, <i>N</i> -( <i>o</i> -methoxybenzyl)- <i>N</i> -methyl-	35	---	---	---
78---34110		Acetamide, 2-[( <i>o</i> -methoxybenzyl)oxy]- <i>N,N</i> -dipentyl-	53	---	---	---
79---34107		Acetamide, 2-[( <i>o</i> -methoxybenzyl)oxy]- <i>N,N</i> -dipropyl-	56	---	---	---
80---70240		Acetamide, <i>N</i> -( <i>o</i> -methoxybenzyl)- <i>N</i> -propyl-	1	0	---	---
81---70239		Acetamide, <i>N</i> -(1-methoxy-3,7-dimethyl-6-octenyl)- <i>N</i> -propyl-	10	22	---	---
82---33506		Acetamide, 2-( <i>o</i> -methoxyphenoxy)- <i>N,N</i> -dipentyl-	35	---	---	---
83---33507		Acetamide, 2-( <i>p</i> -methoxyphenoxy)- <i>N,N</i> -dipentyl-	35	---	---	---

See footnotes at end of table.

TABLE 1.—Comparative effectiveness of synthetic and botanical compounds evaluated as repellents against 4 cockroach species—Continued

Item	(AI3- )	Compound	Cockroaches in treated carton <sup>1</sup>			
			German	American	Oriental	Brown-banded
SYNTHETICS—Continued						
			Percent	Percent	Percent	Percent
84---33486		Acetamide, 2-( <i>o</i> -methoxyphenoxy)- <i>N,N</i> -dipropyl-	49	---	---	---
85---33487		Acetamide, 2-( <i>p</i> -methoxyphenoxy)- <i>N,N</i> -dipropyl-	80	50	---	---
86---33502		Acetamide, 2-( <i>o</i> -methoxyphenoxy)- <i>N</i> -nonyl-	46	---	---	---
87---33503		Acetamide, 2-( <i>p</i> -methoxyphenoxy)- <i>N</i> -nonyl-	38	---	---	---
88---33501		Acetamide, 2-( <i>p</i> -methoxyphenoxy)- <i>N</i> -octyl-	62	---	---	---
89---33480		Acetamide, 2-( <i>o</i> -methoxyphenoxy)- <i>N</i> -propyl-	20	25	---	---
90---33481		Acetamide, 2-( <i>p</i> -methoxyphenoxy)- <i>N</i> -propyl-	25	---	---	---
91---2832		Acetamide, <i>N</i> -pentyl-	40	46	---	---
92---70306		Acetamide, <i>N</i> -propyl- <i>N</i> -( <i>α,3,4,5</i> -tetramethoxybenzyl)-	60	---	---	---
93---23541		Acetanilide, 2'-bromo-2-chloro-	37	2	---	---
94---2484		Acetanilide, <i>N</i> -butyl-	5	10	1	9
95---23550		Acetanilide, <i>N</i> -butyl-2-chloro-	34	2	---	---
96---1088		Acetanilide, 2-chloro-	42	62	---	---
97---23549		Acetanilide, 2-chloro- <i>N</i> -ethyl-	22	1	---	---
98---23560		Acetanilide, 2-chloro- <i>N</i> -isopentyl-	28	4	---	---
99---23548		Acetanilide, 2-chloro- <i>N</i> -methyl-	24	2	---	---
100---23563		Acetanilide, 2-chloro-2'-nitro-	44	27	---	---
101---23559		Acetanilide, 2-chloro- <i>N</i> -pentyl-	40	12	---	---
102---23539		Acetanilide, 2,2'-dichloro-	34	0	---	---
103---23538		Acetanilide, 2,3'-dichloro-	26	13	---	---
104---23540		Acetanilide, 2,4'-dichloro-	34	30	---	---
105---5523		Acetanilide, <i>N</i> -ethyl-	38	5	---	---
106---17307		Acetanilide, 4'-hydroxy-2'-pentadecyl-, acetate	50	42	---	---
107---5528		Acetanilide, <i>N</i> -isopentyl-	3	13	2	1
108---3341		Acetanilide, <i>N</i> -isopropyl-	22	3	---	---
109---5816		Acetanilide, <i>N</i> -methyl-	56	20	---	---
110---23561		Acetanilide, 2,2',5'-trichloro-	28	44	---	---
111---23553		<i>o</i> -Acetaniside, 2-chloro-	50	34	---	---
112---23554		<i>p</i> -Acetaniside, 2-chloro-	64	54	---	---
113---21296		Acetic acid, (2-benzothiazolylthio)-, ethyl ester	52	30	---	---
114---18343		Acetic acid, chloro-, benzyl ester	16	22	---	---
115---18417		Acetic acid, chloro-, 2- <i>sec</i> -butylcyclohexyl ester	25	42	---	---
116---18416		Acetic acid, chloro-, 2-( <i>p</i> - <i>tert</i> -butylphenoxy)ethyl ester	42	58	---	---
117---18412		Acetic acid, chloro-, 2-chloroethyl ester	38	40	---	---
118---18409		Acetic acid, chloro-, 2-cyclohexylethyl ester	39	16	---	---
119---18524		Acetic acid, chloro-, 1,3-dimethylbutyl ester	40	52	---	---
120---18525		Acetic acid, chloro-, 1-ethylpentyl ester	43	36	---	---
121---18523		Acetic acid, chloro-, 1-ethylpropyl ester	36	67	---	---
122---18498		Acetic acid, chloro-, 2-ethyl-1-propyltrimethylene ester	40	51	---	---
123---18499		Acetic acid, chloro-, isobutyl ester	42	70	---	---
124---18526		Acetic acid, chloro-, 1-isobutyl-3-methylbutyl ester	41	82	---	---
125---18414		Acetic acid, chloro-, 2-isopropylcyclohexyl ester	31	43	---	---
126---18503		Acetic acid, chloro-, 2-methoxyethyl ester	62	24	---	---
127---18484		Acetic acid, chloro-, 4-methylcyclohexyl ester	37	23	---	---

See footnotes at end of table.

TABLE 1.—Comparative effectiveness of synthetic and botanical compounds evaluated as repellents against 4 cockroach species—Continued

Item	(AI3—)	Compound	Cockroaches in treated carton <sup>1</sup>			
			German	American	Oriental	Brown-banded
SYNTHETICS—Continued						
128—18522		Acetic acid, chloro-, 1-methylheptyl ester	62	39	---	---
129—18487		Acetic acid, chloro-, 1-methyltrimethylene ester	40	40	---	---
130—18495		Acetic acid, chloro-, pentamethylene ester	38	52	---	---
131—18405		Acetic acid, chloro-, phenethyl ester	20	7	---	---
132—18407		Acetic acid, chloro-, 3-phenylpropyl ester	1	18	---	---
133—18500		Acetic acid, chloro-, propylene ester	38	30	---	---
134—5831		Acetic acid, cyanophenyl-, ethyl ester	57	16	---	---
135—28464		Acetoacetamide, <i>N</i> -piperonyl-	14	---	---	---
136—23566		<i>o</i> -Acetophenetide, 2-chloro-	30	48	---	---
137—23575		<i>p</i> -Acetophenetide, 2-chloro-	56	50	---	---
138—1029		Acetophenone, 4'-ethoxy-	27	13	---	---
139—23534		<i>o</i> -Acetotolidide, 2-chloro-	46	4	---	---
140—23536		<i>p</i> -Acetotolidide, 2-chloro-	36	49	---	2
141—70546		Acrylamide, <i>N</i> -dodecyl-	68	---	---	---
142—70545		Acrylamide, <i>N</i> -octadecyl-	0	5	0	2
143—15687		Acrylic acid, octadecyl ester	32	---	---	---
144—10548		Acrylic acid, 3-benzoyl-, ethyl ester	18	17	---	---
145—70550		Acrylic acid, 2-heptyl-	0	1	0	16
146—21699		Acrylic acid, 3-[3,4-(methylenedioxy) phenyl]-2-phenyl-, ethyl ester	52	20	---	---
147—21732		Acrylic acid, 3-[3,4-(methylenedioxy) phenyl]-2-phenyl-, methyl ester	40	26	---	---
148—26664		$\beta$ -Alanine, <i>N,N</i> -diethyl-, methyl ester	42	---	---	---
149—14640		Aniline, 3,5-dibromo-	56	67	---	---
150—15354		Aniline, <i>N</i> -ethyl- <i>N</i> -nitroso-	22	12	---	---
151—34459		<i>o</i> -Anisamide, 4-chloro- <i>N,N</i> -diethyl-	19	35	---	---
152—33863		<i>o</i> -Anisamide, 3,5-dibromo- <i>N,N</i> -diethyl-	40	28	---	---
153—33862		<i>o</i> -Anisamide, 3,5-dichloro- <i>N,N</i> -diethyl-	20	18	---	---
154—34457		<i>o</i> -Anisamide, <i>N,N</i> -diethyl-3,5-diido-	50	---	---	---
155—20810		<i>o</i> -Anisamide, <i>N,N</i> -diethyl-3-methyl-	10	8	---	---
156—34234		<i>o</i> -Anisic acid, 3,5-dibromo-, methyl ester	26	---	---	---
157—70081		Anisole, 3-methyl-4-(methylthio)-	7	22	---	6
158—70080		Anisole, 4-(methylthio)-	26	---	---	---
159—23569		Anthranilic acid, <i>N</i> -(chloroacetyl)-, methyl ester	50	52	---	---
160—70209		1 <i>H</i> -Azepine, 1-(butylsulfonyl) hexahydro-	6	4	---	---
161—35469		1 <i>H</i> -Azepine, 1-butyrylhexahydro-	1	1	0	3
162—35760		1 <i>H</i> -Azepine, 1-(4-chlorobutyryl) hexahydro-	12	26	12	52
163—35766		1 <i>H</i> -Azepine, 1-(3-cyclohexen-1-ylcarbonyl) hexahydro-	10	2	1	2
164—33514		1 <i>H</i> -Azepine, 1-decanoylhexahydro-	67	---	---	---
165—32806		1 <i>H</i> -Azepine, 1-[[2,2-dimethyl-3-(2-methylpropenyl)-cyclopropyl]carbonyl]hexahydro-	0	0	0	0
166—33513		1 <i>H</i> -Azepine, 1-heptanoylhexahydro-	2	6	0	2
167—32849		1 <i>H</i> -Azepine, hexahydro-1-hexanoyl-	0	0	0	1
168—34636		1 <i>H</i> -Azepine, hexahydro-1-[(3-isopropyl-1-methylcyclopropyl)carbonyl]-	30	35	12	1
169—32807		1 <i>H</i> -Azepine, hexahydro-1-isovaleryl-	24	---	---	---
170—32840		1 <i>H</i> -Azepine, hexahydro-1-lauroyl-	50	---	---	---

See footnotes at end of table.

TABLE 1.—Comparative effectiveness of synthetic and botanical compounds evaluated as repellents against 4 cockroach species—Continued

Item	(AI3- )	Compound	Cockroaches in treated carton <sup>1</sup>			
			German	American	Oriental	Brown-banded
SYNTHETICS—Continued						
			Percent	Percent	Percent	Percent
171----35726	1 <i>H</i> -Azepine, hexahydro-1-[ (o-methoxyphenoxy)-acetyl]-	63	---	---	---	---
172----35723	1 <i>H</i> -Azepine, hexahydro-1-[ (p-methoxyphenoxy)-acetyl]-	32	---	---	---	---
173----35770	1 <i>H</i> -Azepine, hexahydro-1-[ (2-methylcyclohexyl)-carbonyl]-	9	18	0	0	
174----32841	1 <i>H</i> -Azepine, hexahydro-1-myristoyl-	6	41	---	---	---
175----32839	1 <i>H</i> -Azepine, hexahydro-1-nonanoyl-	65	---	---	---	---
176----32838	1 <i>H</i> -Azepine, hexahydro-1-octanoyl-	60	---	---	---	---
177----32851	1 <i>H</i> -Azepine, hexahydro-1-palmitoyl-	48	---	---	---	---
178----35517	1 <i>H</i> -Azepine, hexahydro-1-tridecanoyl-	48	---	---	---	---
179----33515	1 <i>H</i> -Azepine, hexahydro-1-undecanoyl-	50	---	---	---	---
180----35463	1 <i>H</i> -Azepine, hexahydro-1-valeryl-	1	1	0	0	
181---- 2069	Benzaldehyde, 3,4-diethoxy-	55	40	---	---	---
182----33464	Benzamide, o-benzoyl- <i>N,N</i> -diethyl-	43	---	---	---	---
183----70008	Benzamide, <i>N,N</i> -bis (2-methoxyethyl)-	54	---	---	---	---
184----20299	Benzamide, o-bromo- <i>N,N</i> -diethyl-	19	5	---	---	---
185----28962	Benzamide, <i>N</i> -butyl- <i>N</i> -(3,7-dimethyl-1,6-octadienyl)-	6	59	51	16	
186----70411	Benzamide, <i>N</i> -butyl- <i>N</i> -(2-ethyl-1-hexenyl)-	63	---	---	---	---
187----70308	Benzamide, <i>N</i> -butyl- <i>N</i> -isobutyl-	0	3	---	---	---
188----28973	Benzamide, <i>N</i> -butyl- <i>N</i> - <i>p</i> -menth-3-en-3-yl-	11	89	---	59	
189----28972	Benzamide, <i>N</i> -butyl- <i>N</i> -(2-methylpropenyl)-	5	5	0	0	
190----70014	Benzamide, <i>m</i> -chloro- <i>N,N</i> -bis (2-methoxyethyl)-	50	---	---	---	---
191----70045	Benzamide, <i>m</i> -chloro- <i>N,N</i> -dicyclohexyl-	16	8	---	64	
192----70044	Benzamide, o-chloro- <i>N,N</i> -dicyclohexyl-	34	---	---	---	---
193----70051	Benzamide, p-chloro- <i>N,N</i> -dicyclohexyl-	40	---	---	---	---
194----14147	Benzamide, o-chloro- <i>N,N</i> -diethyl-	0	2	---	---	---
195----33465	Benzamide, 2-chloro- <i>N,N</i> -diethyl-4-nitro-	39	---	---	---	---
196----33466	Benzamide, 2-chloro- <i>N,N</i> -diethyl-5-nitro-	46	---	---	---	---
197----70015	Benzamide, <i>m</i> -chloro- <i>N,N</i> -dihexyl-	24	---	---	---	---
198----70038	Benzamide, <i>p</i> -chloro- <i>N,N</i> -dihexyl-	33	---	---	---	---
199----70085	Benzamide, o-chloro- <i>N,N</i> -dipentyl-	56	60	---	---	---
200----70016	Benzamide, <i>m</i> -chloro- <i>N,N</i> -dipropyl-	11	29	4	4	
201----14753	Benzamide, <i>p</i> -chloro- <i>N,N</i> -dipropyl-	49	27	---	---	---
202----70017	Benzamide, <i>m</i> -chloro- <i>N</i> -dodecyl-	90	69	---	---	---
203----70032	Benzamide, o-chloro- <i>N</i> -dodecyl-	24	88	---	62	
204----70039	Benzamide, <i>p</i> -chloro- <i>N</i> -dodecyl-	42	---	---	---	---
205----70019	Benzamide, <i>m</i> -chloro- <i>N</i> -furfuryl-	92	23	---	44	
206----70041	Benzamide, o-chloro- <i>N</i> -furfuryl-	20	34	---	---	---
207----70040	Benzamide, <i>p</i> -chloro- <i>N</i> -furfuryl-	86	46	---	---	---
208----70018	Benzamide, <i>m</i> -chloro- <i>N</i> -furfuryl- <i>N</i> -methyl-	24	---	---	---	---
209----70042	Benzamide, o-chloro- <i>N</i> -furfuryl- <i>N</i> -methyl-	33	---	---	---	---
210----70048	Benzamide, <i>p</i> -chloro- <i>N</i> -furfuryl- <i>N</i> -methyl-	8	20	48	21	
211----70013	Benzamide, <i>m</i> -chloro- <i>N</i> -(2-methoxy-1-methylethyl)-	59	---	---	---	---
212----70031	Benzamide, o-chloro- <i>N</i> -(2-methoxy-1-methylethyl)-	38	---	---	---	---
213----70037	Benzamide, <i>p</i> -chloro- <i>N</i> -(2-methoxy-1-methylethyl)-	46	---	---	---	---
214----33451	Benzamide, o-cyano- <i>N,N</i> -diethyl-	40	---	---	---	---

See footnotes at end of table.

TABLE 1.—Comparative effectiveness of synthetic and botanical compounds evaluated as repellents against 4 cockroach species—Continued

Item	(AI8- )	Compound	Cockroaches in treated carton <sup>1</sup>			
			German	American	Oriental	Brown-banded
SYNTHETICS—Continued						
215----70412	Benzamide, <i>N</i> -cyclohexyl- <i>N</i> -(2-ethyl-1-hexenyl)-	46	---	---	---	---
216----28971	Benzamide, <i>N</i> -cyclohexyl- <i>N</i> -(2-methylpropenyl)-	35	---	---	---	---
217----14755	Benzamide, <i>N,N</i> -dibutyl- <i>p</i> -chloro-	40	42	---	---	---
218----34476	Benzamide, <i>N,N</i> -dibutyl- <i>m</i> -(methylthio)-	33	---	---	---	---
219----34475	Benzamide, <i>N,N</i> -dibutyl- <i>o</i> -(methylthio)-	48	---	---	---	---
220----34477	Benzamide, <i>N,N</i> -dibutyl- <i>p</i> -(methylthio)-	32	---	---	---	---
221----4368	Benzamide, <i>N,N</i> -dibutyl- <i>m</i> -nitro-	64	31	---	---	---
222----33422	Benzamide, 2,5-dichloro- <i>N,N</i> -diethyl-	17	10	---	---	---
223----33421	Benzamide, 3,5-dichloro- <i>N,N</i> -diethyl-	6	3	---	---	---
224----15267	Benzamide, 2,4-dichloro- <i>N,N</i> -dipropyl-	54	32	---	---	---
225----1197	Benzamide, <i>N,N</i> -diethyl-	1	1	1	0	0
226----28739	Benzamide, <i>N,N</i> -diethyl-2,4-dimethoxy-	60	---	---	---	---
227----33462	Benzamide, <i>N,N</i> -diethyl-2,6-dimethoxy-	34	---	---	---	---
228----70093	Benzamide, <i>N,N</i> -diethyl-3,5-dimethoxy-	17	16	---	2	2
229----28726	Benzamide, <i>N,N</i> -diethyl- <i>o</i> -fluoro-	8	4	---	---	---
230----33461	Benzamide, <i>N,N</i> -diethyl- <i>o</i> -iodo-	31	---	---	---	---
231----34456	Benzamide, <i>N,N</i> -diethyl- <i>p</i> -iodo-	41	---	---	---	---
232----34468	Benzamide, <i>N,N</i> -diethyl- <i>m</i> -(methylthio)-	52	---	---	---	---
233----33450	Benzamide, <i>N,N</i> -diethyl- <i>o</i> -(methylthio)-	18	12	---	---	---
234----34467	Benzamide, <i>N,N</i> -diethyl- <i>p</i> -(methylthio)-	40	---	---	---	---
235----33448	Benzamide, <i>N,N</i> -diethyl- <i>o</i> -nitro-	38	---	---	---	---
236----8448	Benzamide, <i>N,N</i> -diethyl- <i>p</i> -nitro-	54	---	---	---	---
237----70009	Benzamide, <i>N,N</i> -dihexyl-	70	---	---	---	---
238----34479	Benzamide, <i>N,N</i> -diisobutyl- <i>m</i> -(methylthio)-	34	---	---	---	---
239----34478	Benzamide, <i>N,N</i> -diisobutyl- <i>o</i> -(methylthio)-	50	---	---	---	---
240----34480	Benzamide, <i>N,N</i> -diisobutyl- <i>p</i> -(methylthio)-	74	---	---	---	---
241----4370	Benzamide, <i>N,N</i> -diisobutyl- <i>m</i> -nitro-	45	7	---	---	---
242----34470	Benzamide, <i>N,N</i> -diisopropyl- <i>m</i> -(methylthio)-	28	20	---	---	---
243----34469	Benzamide, <i>N,N</i> -diisopropyl- <i>o</i> -(methylthio)-	46	---	---	---	---
244----34471	Benzamide, <i>N,N</i> -diisopropyl- <i>p</i> -(methylthio)-	59	---	---	---	---
245----34460	Benzamide, <i>o</i> -(dimethylamino)- <i>N,N</i> -diethyl-	20	3	---	---	---
246----70086	Benzamide, <i>N,N</i> -dipentyl-	35	28	---	---	---
247----70010	Benzamide, <i>N</i> -dodecyl-	28	61	---	---	---
248----70012	Benzamide, <i>N</i> -furfuryl-	84	58	---	---	---
249----70011	Benzamide, <i>N</i> -furfuryl- <i>N</i> -methyl-	25	12	23	14	14
250----70273	Benzamide, <i>N</i> -(2-hydroxy-1,1-dimethylethyl)-, benzoate	37	---	---	---	---
251----70275	Benzamide, <i>N</i> -(2-hydroxyethyl)-, benzoate	52	---	---	---	---
252----70006	Benzamide, <i>N</i> -(6-hydroxyhexyl)-	42	---	---	---	---
253----70204	Benzamide, <i>N</i> -isobutyl- <i>N</i> -(2-methylpropenyl)-	2	8	0	5	5
254----70203	Benzamide, <i>N</i> -isopropyl- <i>N</i> -(2-methyl- propenyl)-	14	4	---	0	0
255----70007	Benzamide, <i>N</i> -(2-methoxy-1-methylethyl)-	94	28	31	12	12
256----34473	Benzamide, <i>m</i> -(methylthio)- <i>N,N</i> -dipropyl-	60	---	---	---	---
257----34472	Benzamide, <i>o</i> -(methylthio)- <i>N,N</i> -dipropyl-	40	---	---	---	---
258----34474	Benzamide, <i>p</i> -(methylthio)- <i>N,N</i> -dipropyl-	46	---	---	---	---
259----70174	Benzene, 1-chloro-2,4-diethoxy-	34	---	---	---	---

See footnotes at end of table.

TABLE 1.—Comparative effectiveness of synthetic and botanical compounds evaluated as repellents against 4 cockroach species—Continued

Item	(AI3- )	Compound	Cockroaches in treated carton <sup>1</sup>			
			German	American	Oriental	Brown-banded
SYNTHETICS—Continued						
			Percent	Percent	Percent	Percent
260----70078	Benzene, 1-chloro-2,4-dimethoxy-		4	17	---	14
261----70194	Benzene, 1-cyclohexyl-2,4-diethoxy-		28	---	---	---
262----70094	Benzene, 1-cyclohexyl-2,4-dimethoxy-		8	32	---	---
263----70082	Benzene, 2,4-dimethoxy-1-propyl-		10	10	---	14
264----16634	Benzene, 1,2- (methylenedioxy)-4-[2-(octyl-sulfinyl)propyl]- (sulfoxide)		50	---	---	---
265----70200	Benzene, 1,3,5-trimethoxy-		34	---	---	---
266----33867	Benzenesulfonamide, <i>N,N</i> -diethyl- <i>o</i> -nitro-		48	---	---	---
267---- 898	Benzil		38	36	---	---
268----34122	1,4-Benzodioxan-2-carboxamide, <i>N,N</i> -dibutyl-		46	---	---	---
269----34123	1,4-Benzodioxan-2-carboxamide, <i>N,N</i> -dipentyl-		40	---	---	---
270----34121	1,4-Benzodioxan-2-carboxamide, <i>N,N</i> -dipropyl-		56	---	---	---
271---- 3710	Benzoic acid		48	46	---	---
272----21125	Benzoic acid, isopropylidenehydrazide		17	31	---	58
273---- 3809	Benzoic acid, <i>o</i> -tolyl ester		31	56	---	---
274----34075	Benzoic acid, 2,3-dichloro-, methyl ester		32	---	---	---
275---- 5756	Benzyl alcohol, <i>o</i> -butoxy-		28	5	---	---
276---- 5844	Benzyl alcohol, <i>p</i> -(isopentyloxy)-		25	43	---	---
277---- 5519	Benzyl alcohol, <i>p</i> -propoxy-		52	52	---	---
278----20803	Benzylamine, <i>N</i> -butyl-		14	54	---	---
279----34294	Butanesulfonamide, <i>N,N</i> -dibutyl-		40	---	---	---
280----34292	Butanesulfonamide, <i>N,N</i> -diethyl-		11	8	---	---
281----34293	Butanesulfonamide, <i>N,N</i> -dipropyl-		5	2	---	---
282---- 9480	Butyramide, <i>N</i> -butyl-		67	12	0	1
283----31416	Butyramide, <i>N</i> -butyl-3-methyl-		5	2	---	---
284----18486	Butyramide, <i>N,N</i> -dibutyl-		22	---	---	---
285---- 6147	Butyramide, <i>N,N</i> -diethyl-		57	---	---	---
286----35705	Butyramide, <i>N,N</i> -diisobutyl-		8	13	6	11
287----18420	Butyramide, <i>N,N</i> -diisopropyl-		9	22	7	25
288----18489	Butyramide, <i>N,N</i> -dipentyl-		27	---	---	---
289----18493	Butyramide, <i>N,N</i> -dipropyl-		16	28	---	---
290----15130	Butyramide, <i>N</i> -hexyl-		0	3	0	1
291----15129	Butyramide, <i>N</i> -pentyl-		0	1	0	2
292---- 5780	Butyranilide, <i>N</i> -ethyl-		0	0	---	6
293----21505	Butyric acid, heptyl ester		48	---	---	---
294----32960	Butyric acid, 2,4-hexadienyl ester		33	---	---	---
295---- 2954	Butyric acid, phenethyl ester		28	---	---	---
296----11064	Butyric acid, 2-cyano-3-methyl-, ethyl ester		34	---	---	---
297----34002	Butyric acid, 2-cyano-3-methyl-, methyl ester		38	---	---	---
298----21675	Butyric acid, 3-hydroxy-		50	48	---	---
299----34461	Butyric acid, 2-methyl-, methyl ester		49	---	---	---
300----33264	Carbamic acid, dibutyl-, <i>p</i> -bromophenyl ester		40	---	---	---
301----33176	Carbamic acid, di- <i>sec</i> -butylthio-, <i>S</i> -phenyl ester		13	---	---	---
302----70053	Carbamic acid, dimethyl-, 2,3,4,6-tetrachlorophenyl ester		45	30	---	---
303----33158	Carbamic acid, dimethylthio-, <i>S</i> -( <i>p</i> -bromophenyl) ester		19	---	---	---

See footnotes at end of table.

TABLE 1.—Comparative effectiveness of synthetic and botanical compounds evaluated as repellents against 4 cockroach species—Continued

Item	(AI3- )	Compound	Cockroaches in treated carton <sup>1</sup>			
			German	American	Oriental	Brown-banded
SYNTHETICS—Continued						
			Percent	Percent	Percent	Percent
304---33223		Carbamic acid, ethyldithio-, phenyl ester	6	---	---	---
305---33210		Carbamic acid, propyldithio-, phenyl ester	8	---	---	---
306---33221		Carbanilic acid, <i>m</i> -chlorophenyl ester	16	---	---	---
307---31544		Carbanilic acid, <i>o</i> -methyldithio-, methyl ester	30	---	---	---
308--- 63		Carbonic acid, diphenyl ester	35	39	---	---
309---70052		Carbonic acid, dithio-, <i>O</i> -butyl <i>S</i> -( <i>p</i> -nitrophenacyl) ester	34	---	---	---
310---26941		Carbonic acid, dithio-, <i>O</i> -isopropyl <i>S</i> -( <i>p</i> -nitrophenacyl) ester	20	32	---	---
311---70054		Carbonic acid, dithio-, <i>S</i> -( <i>p</i> -nitrophenacyl) <i>O</i> -propyl ester	50	---	---	---
312---10525		Cinnamic acid, $\alpha$ -cyano-, ethyl ester	54	---	---	---
313---20317		Cinnamic acid, $\alpha$ -cyano- <i>o</i> -methoxy-, ethyl ester	48	---	---	---
314---28074		<i>m</i> -Cresol, 4-(methylthio)-	0	17	---	---
315--- 4919		Crotonic acid, 2-cyano-3-methyl-, ethyl ester	43	---	---	---
316---33249		Crotonic acid, 2-cyano-3-methyl-, methyl ester	32	---	---	---
317---70311		1,3,6-Cycloheptatriene-1-carboxamide, <i>N,N</i> -dibutyl-5,5-dimethyl-	37	---	---	---
318---70310		1,3,6-Cycloheptatriene-1-carboxamide, <i>N,N</i> -diethyl-5,5-dimethyl-	2	0	---	---
319--- 7174		Cyclohexaneacetic acid, $\alpha$ -cyano-, methyl ester	50	---	---	---
320--- 4922		$\Delta^{1,\alpha}$ -Cyclohexaneacetic acid, $\alpha$ -cyano-, methyl ester	26	1	2	0
321---12010		Cyclohexanobutyric acid	1	10	---	39
322---35771		Cyclohexanecarboxamide, <i>N,N</i> -diethyl-2-methyl-	7	10	0	2
323---70087		Cyclohexanecarboxylic acid, 2-hydroxyethyl ester	5	4	---	12
324---14244		Cyclohexanepropionic acid	7	5	---	---
325--- 2133		Cyclohexanol, 2-phenyl-	13	0	---	---
326---25215		Cyclohexanone, 2-(1-aminocyclohexyl)-	32	46	---	---
327---35767		3-Cyclohexene-1-carboxamide, <i>N,N</i> -diethyl-	16	2	0	2
328--- 6535		2-Cyclohexene-1-carboxylic acid, 2,6-dimethyl-4-oxo-, ethyl ester	39	3	---	---
329---20221		3-Cyclohexene-1-carboxylic acid, 6-methyl-	52	31	---	---
330---33899		Cyclopentaneacetic acid, $\alpha$ -cyano-, methyl ester	50	---	---	---
331--- 4923		$\Delta^{1,\alpha}$ -Cyclopentaneacetic acid, $\alpha$ -cyano-, methyl ester	37	---	---	---
332---34284		Cyclopentanecarboxamide, <i>N,N</i> -dibutyl-3-isopropyl-1-methyl-	41	---	---	---
333---20367		Cyclopentanecarboxamide, <i>N,N</i> -diethyl-3-isopropyl-1-methyl-	1	0	0	0
334---34283		Cyclopentanecarboxamide, 3-isopropyl-1-methyl- <i>N,N</i> -dipropyl-	6	2	0	2
335---14249		Cyclopentanecarboxylic acid, 3-isopropyl-1-methyl-(fencholic acid—Standard) <sup>2</sup>	1.64	.88	.89	8.52
336---20332		Cyclopentanecarboxylic acid, 3-isopropyl-1-methyl- $\alpha$ -allylpiperonyl ester	22	24	---	---
337---20439		Cyclopentanecarboxylic acid, 3-isopropyl-1-methyl-cinnamyl ester	19	27	---	---

See footnotes at end of table.

TABLE 1.—Comparative effectiveness of synthetic and botanical compounds evaluated as repellents against 4 cockroach species—Continued

Item	(AI3- )	Compound	Cockroaches in treated carton <sup>1</sup>			
			German	American	Oriental	Brown-banded
SYNTHETICS—Continued						
338----20438		Cyclopentanecarboxylic acid, 3-isopropyl-1-methyl-, <i>p</i> -methoxybenzyl ester	24	18	---	---
339----20429		Cyclopentanecarboxylic acid, 3-isopropyl-1-methyl-, piperonyl ester	56	39	---	---
340----20453		Cyclopropanecarboxylic acid, 2,2-dimethyl-3-(2-methylpropenyl)-	24	27	26	27
341----20888		Cyclopropanecarboxylic acid, 2,2-dimethyl-3-(2-methylpropenyl)-, anhydride	8	11	28	24
342----27662		Cyclopropanecarboxylic acid, 2,2-dimethyl-3-(2-methylpropenyl)-, (5-benzyl-3-furyl) methyl ester, <i>trans</i> -(+)-	2	4	---	2
343----30682		Cyclopropanecarboxylic acid, 2,2-dimethyl-3-(2-methylpropenyl)-, 2-bromo-4,5-(methylenedioxy) phenyl ester	42	42	58	64
344----16275		Cyclopropanecarboxylic acid, 2,2-dimethyl-3-(2-methylpropenyl)-, ester with 2-ethyl-4-hydroxy-3-methyl-2-cyclopenten-1-one, <i>trans</i> -(+)-	0	0	0	2
345----31012		Cyclopropanecarboxylic acid, 2,2-dimethyl-3-(2-methylpropenyl)-, ethyl ester	18	48	---	---
346----20886		Cyclopropanecarboxylic acid, 2,2-dimethyl-3-(2-methylpropenyl)-, propyl ester	---	26	---	---
347----21482		Cyclopropanecarboxylic acid, 3-isobutyl-2,2-dimethyl-	11	7	19	15
348----70544		Cyclopropaneoctanoic acid, 2,2-dichloro-3-[(2,2-dichloro-3-pentylcyclopropyl) methyl]-, methyl ester	42	48	---	---
349----70543		Cyclopropaneoctanoic acid, 2,2-dichloro-3-octyl-, methyl ester	16	73	55	---
350----35234		Decanamide, <i>N,N</i> -dibutyl-	71	---	---	---
351----34697		Decanamide, <i>N,N</i> -diethyl-	13	20	0	2
352----35704		Decanamide, <i>N,N</i> -diisopropyl-	16	11	12	0
353----34960		Decanamide, <i>N,N</i> -dimethyl-	0	---	---	---
354----35233		Decanamide, <i>N,N</i> -dipropyl-	16	46	---	---
355----4453		Decanoic acid	54	36	---	---
356----70091		Decanoic acid, 2-hydroxyethyl ester	0	9	---	0
357----27199		Decanoic acid, 2-bromo-, 2-propynyl ester	8	16	---	---
358----33877		3-Decanone, 4-methyl-	31	12	---	---
359----9214		Decanophenone, <i>ar</i> -hydroxy-	8	24	---	---
360----70541		1,3-Diazaspiro[4.5]decane-2,4-dione, 1-stearoyl-	25	20	44	---
361----70542		1,3-Diazaspiro[4.5]decane-2,4-dione, 3-stearoyl-	37	---	---	---
362----17596		4a(4 <i>H</i> )-Dibenzofurancarboxaldehyde, 1,5a,6,9,9a,9b-hexahydro-(MGK Repellent 11)	12	6	2	8
363----18013		4a(4 <i>H</i> )-Dibenzofuranmethanol, 1,5a,6,9,9a,9b-hexahydro-	10	0	---	---
364----9005		Dibenzylamine, <i>N</i> -[2-[(diisopropyl- <i>m</i> -tolyl)oxy]-ethyl]-	52	40	---	---
365----9004		Dibenzylamine, <i>N</i> -[2-[(diisopropyl- <i>o</i> -tolyl)oxy]-ethyl]-	48	38	---	---

See footnotes at end of table.

TABLE 1.—Comparative effectiveness of synthetic and botanical compounds evaluated as repellents against 4 cockroach species—Continued

Item	(AI3- )	Compound	Cockroaches in treated carton <sup>1</sup>			
			German	American	Oriental	Brown-banded
SYNTHETICS—Continued						
			Percent	Percent	Percent	Percent
366----70181		Di-2,6-octadienylamine, <i>N</i> -[2-[2-(diethylamino)-ethoxy]-1,1-dimethylethyl]-3,3',7,7'-tetramethyl-, (E,E)-	28	---	---	---
367----70283		Di-2,6-octadienylamine, <i>N</i> -[2-[2-(diethylamino)-ethoxy]propyl]-3,3',7,7'-tetramethyl-	12	42	---	---
368----15029		Diocylamine	12	37	---	---
369----70414		<i>m</i> -Dioxane, 5-butyl-2-(2,6-dimethyl-5-heptenyl)-5-ethyl-	25	40	---	---
370----70403		<i>m</i> -Dioxane, 2-(2,6-dimethyl-5-heptenyl)-	6	24	24	18
371----5533		<i>m</i> -Dioxane, 4-( <i>p</i> -methoxyphenyl)-5-methyl-	20	5	---	---
372----70402		1,3-Dioxolane, 2-(2,6-dimethyl-5-heptenyl)-	9	24	1	6
373----6381		1,3-Dioxolane-2-propionic acid, 2-methyl-, cyclohexyl ester	26	34	---	---
374----25362		Dipropylamine, 3,3'-diamino- <i>N</i> -methyl-	20	57	---	---
375----2185		Dodecanamide, <i>N,N</i> -dibutyl-	53	---	---	---
376----1019		Dodecanamide, <i>N,N</i> -diethyl-	46	---	---	---
377----26661-X		Dodecanamide, <i>N,N</i> -dimethyl- (95 percent), mixture with related amides (5 percent)	0	2	---	---
378----35237		Dodecanamide, <i>N,N</i> -dipropyl-	0	36	---	---
379----33879		3-Dodecanone, 4-methyl-	37	---	---	---
380----34178		2,6,10-Dodecatrienoic acid, 2-cyano-3,7,11-trimethyl-, methyl ester	34	---	---	---
381----2812		Ethanol, 2-( <i>p</i> -sec-butylphenoxy)-	7	17	---	---
382----5014		Ethanol, 2-(carvacryloxy)-	6	16	---	---
383----35583		Ethanol, 2-[( <i>p</i> -chlorophenyl)thio]-, acetate	32	---	---	---
384----3395		Ethanol, 2-( <i>p</i> -cumenyloxy)-	10	9	---	---
385----301		Ethanol, 2-[2-(hexyloxy)ethoxy]-	26	24	---	---
386----24828		Ethanol, 2-(octylthio)-	1	---	---	---
387----70083		Ethanol, 2,2'-( <i>m</i> -phenylenedioxy)di-	4	50	---	---
388----35604		Ethanol, 2-( <i>p</i> -tolylthio)-, acetate	56	---	---	---
389----70193		Ether, 2,6-dimethyl-1,5-heptadienyl methyl	26	---	---	---
-----14249		Fencholic acid (STANDARD) (See item 335.)				
390----70088		Flavan, 2',4',7-trimethoxy-2,4,4-trimethyl-	42	---	---	---
391----70406		2-Furanacetic acid, 2,5-dihydro-3-methyl-5-oxo-	20	45	---	---
392----70401		2-Furanacetic acid, 2,5-dihydro-3-methyl-5-oxo-, ethyl ester	50	---	---	---
393----70408		2-Furanacetic acid, 2,5-dihydro-3-methyl-5-oxo-, methyl ester	47	---	---	---
394----3662		2-Furanacrylic acid	10	49	---	---
395----7799		2-Furanacrylic acid, $\alpha$ -cyano-, ethyl ester	46	---	---	---
396----751		2(3 <i>H</i> )-Furanone, 5-heptyldihydro-	12	14	---	---
397----16500		2-Furoic acid	48	55	---	---
398----70090		2-Furoic acid, 2-hydroxyethyl ester	82	64	---	---
399----20768		<i>D</i> -Glucose, diethyl mercaptal, pentaacetate	58	70	---	---
400----7407		Glycidic acid, 3-phenyl-, allyl ester	19	25	---	---
401----35460		Heptanamide, <i>N,N</i> -dibutyl-	19	0	0	0
402----35459		Heptanamide, <i>N,N</i> -diethyl-	0	2	0	3

See footnotes at end of table.

TABLE 1.—Comparative effectiveness of synthetic and botanical compounds evaluated as repellents against 4 cockroach species—Continued

Item	(AI3- )	Compound	Cockroaches in treated carton <sup>1</sup>			
			German	American	Oriental	Brown-banded
SYNTHETICS—Continued						
			Percent	Percent	Percent	Percent
403---35707	Heptanamide, <i>N,N</i> -diisobutyl-		2	2	1	0
404---35701	Heptanamide, <i>N,N</i> -diisopropyl-		3	4	0	1
405---35711	Heptanamide, <i>N,N</i> -dipentyl-		53	---	---	---
406---35509	Heptanamide, <i>N,N</i> -dipropyl-		4	0	0	0
407---35714	Heptanamide, <i>N</i> -pentyl-		55	---	---	---
408---25920	Heptanamide, <i>N,N</i> ,2-triethyl-		4	---	---	---
409---34243	Heptanoic acid, 3-butyl-2-cyano-, butyl ester		46	---	---	---
410---34447	Heptanoic acid, 3-butyl-2-cyano-, ethyl ester		2	12	2	3
411---34245	Heptanoic acid, 3-butyl-2-cyano-, isopropyl ester		22	---	---	---
412---33830	Heptanoic acid, 3-butyl-2-cyano-, methyl ester		1	0	0	1
413---34244	Heptanoic acid, 3-butyl-2-cyano-, propyl ester		34	---	---	---
414---33876	Heptanoic acid, 2-cyano-, ethyl ester		24	---	---	---
415---33875	Heptanoic acid, 2-cyano-, methyl ester		15	12	12	14
416---34194	2-Heptenoic acid, 3-butyl-2-cyano-, butyl ester		55	---	---	---
417---34446	2-Heptenoic acid, 3-butyl-2-cyano-, ethyl ester		20	14	---	---
418---34193	2-Heptenoic acid, 3-butyl-2-cyano-, isopropyl ester		50	---	---	---
419---33829	2-Heptenoic acid, 3-butyl-2-cyano-, methyl ester		10	4	0	1
420---34192	2-Heptenoic acid, 3-butyl-2-cyano-, propyl ester		34	---	---	---
421---33870	2-Heptenoic acid, 2-cyano-, ethyl ester		13	8	4	2
422---33872	2-Heptenoic acid, 2-cyano-, methyl ester		65	18	10	20
423---34458	5-Hepten-1-ol, 2,6-dimethyl-		16	12	---	---
424---15136	Heptylamine, <i>N</i> -(2-butoxyethyl)-		9	32	---	---
425---8006	Hexadecanamide, <i>N,N</i> -dibutyl-		29	52	---	---
426---35519	Hexadecanamide, <i>N,N</i> -diethyl-		34	---	---	---
427---35520	Hexadecanamide, <i>N,N</i> -dipropyl-		34	---	---	---
428---22879	Hexanamide, <i>N</i> -butyl-		29	---	---	---
429---35458	Hexanamide, <i>N,N</i> -dibutyl-		2	0	0	2
430---22213	Hexanamide, <i>N</i> -ethyl-		25	---	---	---
431---22212	Hexanamide, <i>N</i> -hexyl-		16	36	---	---
432---70160	Hexanediamide, 2,5-dibromo-		49	---	---	---
433---70056	Henanediamide, <i>N,N,N',N'</i> -tetraethyl-		14	62	---	---
434---26936	Hexanenitrile, 5-oxo-		22	---	---	---
435---7701	Hexanoic acid		14	---	---	---
436---4910	Hexanoic acid, 2-cyano-, ethyl ester		28	---	---	---
437---33874	Hexanoic acid, 2-cyano-, methyl ester		38	---	---	---
438---34246	Hexanoic acid, 2-cyano-3-isobutyl-5-methyl-, butyl ester		6	8	0	8
439---34250	Hexanoic acid, 2-cyano-3-isobutyl-5-methyl-, ethyl ester		10	8	---	0
440---34249	Hexanoic acid, 2-cyano-3-isobutyl-5-methyl-, isopropyl ester		6	8	---	---
441---34247	Hexanoic acid, 2-cyano-3-isobutyl-5-methyl-, methyl ester		12	2	0	8
442---34248	Hexanoic acid, 2-cyano-3-isobutyl-5-methyl-, propyl ester		6	8	0	0
443---33910	Hexanoic acid, 2-cyano-3-propyl-		31	---	---	---
444---34251	Hexanoic acid, 2-cyano-3-propyl-, butyl ester		20	10	---	1
445---33901	Hexanoic acid, 2-cyano-3-propyl-, ethyl ester		12	7	1	0

See footnotes at end of table.

TABLE 1.—Comparative effectiveness of synthetic and botanical compounds evaluated as repellents against 4 cockroach species—Continued

Item	(AI3- )	Compound	Cockroaches in treated carton <sup>1</sup>			
			German	American	Oriental	Brown-banded
SYNTHETICS—Continued						
			Percent	Percent	Percent	Percent
446----34253		Hexanoic acid, 2-cyano-3-propyl-, isopropyl ester	6	6	---	1
447----33826		Hexanoic acid, 2-cyano-3-propyl-, methyl ester	28	---	---	---
448----34252		Hexanoic acid, 2-cyano-3-propyl-, propyl ester	7	2	0	1
449----24649		2-Hexenal	37	27	36	49
450----34440		2-Hexenamide, 2-cyano- <i>N,N</i> -diethyl-3-propyl-	16	8	---	---
451----33869		2-Hexenoic acid, 2-cyano-, ethyl ester	29	---	---	---
452----33871		2-Hexenoic acid, 2-cyano-, methyl ester	30	---	---	---
453----34208		2-Hexenoic acid, 2-cyano-3-isobutyl-5-methyl-, butyl ester	25	---	---	---
454----4914		2-Hexenoic acid, 2-cyano-3-isobutyl-5-methyl-, ethyl ester	22	16	---	---
455----34207		2-Hexenoic acid, 2-cyano-3-isobutyl-5-methyl-, isopropyl ester	16	8	---	1
456----33868		2-Hexenoic acid, 2-cyano-3-isobutyl-5-methyl-, methyl ester	16	0	1	0
457----34206		2-Hexenoic acid, 2-cyano-3-isobutyl-5-methyl-, propyl ester	19	17	---	3
458----33873		2-Hexenoic acid, 2-cyano-3-methyl-, methyl ester	35	---	---	---
459----33908		2-Hexenoic acid, 2-cyano-3-propyl-	47	---	---	---
460----34191		2-Hexenoic acid, 2-cyano-3-propyl-, butyl ester	10	32	---	---
461----33336		2-Hexenoic acid, 2-cyano-3-propyl-, ethyl ester	16	13	2	1
462----34172		2-Hexenoic acid, 2-cyano-3-propyl-, isopropyl ester	27	---	---	---
463----33476		2-Hexenoic acid, 2-cyano-3-propyl-, methyl ester	4	8	18	8
464----34169		2-Hexenoic acid, 2-cyano-3-propyl-, propyl ester	12	28	---	---
465----28094-X		1-Hexen-3-one, 5-methyl-1-phenyl- and 3-benzylidene-4-methyl-2-pentanone	1	8	---	---
466----70551		Hydracrylic acid, 2-hexadecyl-	50	---	---	---
467----6217		Hydracrylic acid, 3-phenyl-, isopropyl ester	11	12	---	---
468----70547		Hydroxylamine, tristearoyl-	44	---	---	---
469----17434		Indole-3-butyric acid	45	52	---	---
470----15811		Isobutyraldehyde	20	---	---	---
471----34291		Isoquinoline, 2-(butylsulfonyl)-1,2,3,4-tetrahydro-	30	---	---	---
472----16106		Isovaleraldehyde	35	---	---	---
473----3130		Lactic acid	39	23	---	---
474----112		Lauric acid	22	22	---	---
475----70059		Lauric acid, diester with <i>N,N</i> -bis(2-hydroxyethyl)-dodecanamide	54	---	---	---
476----11010		Linoleic acid	5	14	---	---
477----33900		Malononitrile, (1-ethylpropylidene)-	58	---	---	---
478----34152		Malononitrile, (1-propylbutylidene)-	28	---	---	---
479----1643		Mandelic acid, ethyl ester	24	22	---	---
480----70092		Mandelic acid, 2-hydroxyethyl ester	15	60	---	---
481----20549		Mandelic acid, tetrahydrofurfuryl ester	24	11	---	---
482----2844		Morpholine, 4-acetyl-	54	22	---	---
483----27198		Morpholine, 4-(2-bromodecanoyl)-	52	---	---	---
484----18278		Morpholine, 4-butyryl-	61	50	---	---
485----35655		Morpholine, 4-butyryl-2,6-dimethyl-	4	26	---	---

See footnotes at end of table.

TABLE 1.—Comparative effectiveness of synthetic and botanical compounds evaluated as repellents against 4 cockroach species—Continued

Item	(AI3- )	Compound	Cockroaches in treated carton <sup>1</sup>			
			German	American	Oriental	Brown-banded
SYNTHETICS—Continued						
			Percent	Percent	Percent	Percent
486—23546		Morpholine, 4-(chloroacetyl)-	26	52	---	---
487—18285		Morpholine, 4-decanoyl-	8	44	---	---
488—35661		Morpholine, 4-decanoyl-2,6-dimethyl-	31	---	---	---
489—27196		Morpholine, 4-(2-decenoyl)-	2	68	---	---
490—35660		Morpholine, 2,6-dimethyl-4-nonanoyl-	41	30	---	---
491—35659		Morpholine, 2,6-dimethyl-4-octanoyl-	50	---	---	---
492—35656		Morpholine, 2,6-dimethyl-4-valeryl-	12	3	1	6
493—27197		Morpholine, 4-(2-dodecenoyl)-	44	---	---	---
494—35669		Morpholine, 4-heptanoyl-	10	5	1	6
495—35658		Morpholine, 4-heptanoyl-2,6-dimethyl-	9	0	0	0
496—35668		Morpholine, 4-hexanoyl-	0	4	1	18
497—35657		Morpholine, 4-hexanoyl-2,6-dimethyl-	0	1	0	0
498—18284		Morpholine, 4-nonanoyl-	4	44	---	---
499—27195		Morpholine, 4-(2-nonenoyl)-	2	56	---	---
500—18274		Morpholine, 4-octanoyl-	0	10	1	0
501—27194		Morpholine, 4-(2-octenoyl)-	1	36	---	---
502—35667		Morpholine, 4-valeryl-	10	21	---	---
503—15266		Naptho[2,3- <i>d</i> ]-1,3-dioxole-5,6-dicarboxylic acid, 5,6,7,8-tetrahydro-7-methyl-, dipropyl ester	62	---	---	---
504—28637		2-Naphthoic acid, 1,2,3,4,5,6,7,8-octahydro- 8,8-dimethyl-, ethyl ester	5	22	---	---
505—106		1-Naphthol	25	36	---	---
506—24292		1,4-Naphthoquinone	0	0	0	0
507—12099		1,4-Naphthoquinone, 2-hydroxy-	45	---	---	---
508—85		1-Naphthylamine	68	51	---	---
509—15833		Nicotinium, 1'-(2-bromoethyl)—bromide, polymer	44	52	---	---
510—15831		Nicotinium, 1'-(2,4-dichlorobenzyl)—chloride	76	56	---	---
511—15800		Nicotinium, 1'-dodecyl—bromide	62	51	---	---
512—15069		Nicotinium, 1'-dodecyl—chloride	62	57	---	---
513—15834		Nicotinium, 1'-dodecyl—oleate	42	55	---	---
514—15826		Nicotinium, 1'-methyl—methyl sulfate	54	58	---	---
515—35232		Nonanamide, <i>N,N</i> -dibutyl-	25	---	---	---
516—34698		Nonanamide, <i>N,N</i> -diethyl-	0	0	0	0
517—35709		Nonanamide, <i>N,N</i> -diisobutyl-	64	---	---	---
518—35703		Nonanamide, <i>N,N</i> -diisopropyl-	15	3	0	0
519—35231		Nonanamide, <i>N,N</i> -dipropyl-	39	---	---	---
520—70057		Nonanediamide, <i>N,N,N',N'</i> -tetraethyl-	11	38	---	---
521—33834		Nonanoic acid, 2-cyano-3-hexyl-, methyl ester	35	---	---	---
522—70483		Nonanoic acid, 4,8-dimethyl-	2	27	0	4
523—33878		3-Nonanone, 4-methyl-	28	---	---	---
524—33832		2-Nonenoic acid, 2-cyano-3-hexyl-, methyl ester	32	---	---	---
525—8184		5-Norbornene-2,3-dicarboximide, <i>N</i> -(2-ethylhexyl)-	11	80	---	---
526—1000		5-Norbornene-2,3-dicarboximide, <i>N</i> -pentyl-	2	1	0	1
527—3295-X		Octadecanamide, <i>N,N</i> -dimethyl-, 50 percent, mixture with related <i>N,N</i> -dimethylamides	42	---	---	---
528—70548		Octadecanoic acid, 12-(2-cyanoethoxy)-, methyl ester	30	---	---	---

See footnotes at end of table.

TABLE 1.—Comparative effectiveness of synthetic and botanical compounds evaluated as repellents against 4 cockroach species—Continued

Item	(AI3- )	Compound	Cockroaches in treated carton <sup>1</sup>			
			German	American	Oriental	Brown-banded
SYNTHETICS—Continued						
			Percent	Percent	Percent	Percent
529---15844		Octadecanoic acid, 9,10-dihydroxy-, methyl ester, <i>erythro</i> -	65	---	---	---
530---15843		Octadecanoic acid, 9,10-dihydroxy-, methyl ester, <i>threo</i> -	50	---	---	---
531---70523		Octadecanoic acid, 9,10-epithio-, 2-(2-ethoxyethoxy)ethyl ester	37	---	---	---
532---70035		9-Octadecenamide, <i>N,N</i> -diethyl-	66	---	---	---
533---31081		Octanamide, <i>N</i> -butyl-	20	5	---	---
534---31072		Octanamide, <i>N,N</i> -dibutyl-	62	---	---	---
535---31056		Octanamide, <i>N,N</i> -diethyl-	0	2	0	1
536---35708		Octanamide, <i>N,N</i> -diisobutyl-	58	---	---	---
537---35702		Octanamide, <i>N,N</i> -diisopropyl-	1	0	0	1
538---26660		Octanamide, <i>N,N</i> -dimethyl-	6	0	---	---
539---35712		Octanamide, <i>N,N</i> -dipentyl-	48	---	---	---
540---31066		Octanamide, <i>N,N</i> -dipropyl-	8	4	1	1
541---35717		Octanamide, <i>N</i> -hexyl-	44	---	---	---
542---35715		Octanamide, <i>N</i> -pentyl-	19	27	---	---
543---4162		Octanoic acid	6	8	---	46
544---70058		Octanoic acid, diester with <i>N,N</i> -bis(2-hydroxyethyl)-octanamide	58	---	---	---
545---70089		Octanoic acid, 2-hydroxyethyl ester	1	1	---	2
546---33833		Octanoic acid, 2-cyano-3-pentyl-, methyl ester	8	34	1	2
547---33831		2-Octenoic acid, 2-cyano-3-pentyl-, methyl ester	30	---	---	---
548---70142		1-Oxa-4-azaspiro[4.5]decane, 4-acetyl-	9	26	---	---
549---70147		1-Oxa-4-azaspiro[4.5]decane, 4-acetyl-3,3-dimethyl-	0	0	0	0
550---28930		1-Oxa-4-azaspiro[4.5]decane, 4-acetyl-3-ethyl-	10	0	0	7
551---70331		1-Oxa-4-azaspiro[4.5]decane, 4-acetyl-3-ethyl-(+)-	0	0	0	0
552---70332		1-Oxa-4-azaspiro[4.5]decane, 4-acetyl-3-ethyl-, (-)-	0	0	0	0
553---28876		1-Oxa-4-azaspiro[4.5]decane, 4-benzoyl-	21	88	---	64
554---70279		1-Oxa-4-azaspiro[4.5]decane, 3,4-diethyl-	30	---	---	---
555---70169		1-Oxa-4-azaspiro[4.5]decane, 3,3-dimethyl-4-propionyl-	14	2	---	0
556---70399		1-Oxa-4-azaspiro[4.5]decane, 4-ethyl-	60	---	---	---
557---70172		1-Oxa-4-azaspiro[4.5]decane, 3-ethyl-4-isobutyryl-	42	---	---	---
558---70170		1-Oxa-4-azaspiro[4.5]decane, 3-ethyl-4-propionyl-	37	---	---	---
559---70171		1-Oxa-4-azaspiro[4.5]decane, 4-isobutyryl-3,3-dimethyl-	9	14	---	0
560---70144		1-Oxa-4-azaspiro[4.4]nonane, 4-acetyl-3-ethyl-	8	18	---	0
561---28953		2 <i>H</i> -1,3-Oxazine, 3-acetyl-2-(2,6-dimethyl-5-heptenyl)tetrahydro-	12	32	---	---
562---70430		2 <i>H</i> -1,3-Oxazine, 3-acetyl-2-(2,6-dimethylheptyl)-tetrahydro-	32	---	---	---
563---28951		2 <i>H</i> -1,3-Oxazine, 3-acetyl-2-(1-ethylpentyl)-tetrahydro-	3	0	1	0
564---70198		2 <i>H</i> -1,3-Oxazine, 3-acetyl-2-(1-ethylpropyl)-tetrahydro-	25	---	---	---

See footnotes at end of table.

TABLE 1.—Comparative effectiveness of synthetic and botanical compounds evaluated as repellents against 4 cockroach species—Continued

Item	(AI3- )	Compound	Cockroaches in treated carton <sup>1</sup>			
			German	American	Oriental	Brown-banded
SYNTHETICS—Continued						
565	28949	2H-1,3-Oxazine, 3-acetyltetrahydro-2-isopropyl-	32	---	---	---
566	28877	2H-1,3-Oxazine, 3-acetyltetrahydro-2-phenyl-	0	0	---	44
567	28964	2H-1,3-Oxazine, 3-acetyltetrahydro-2-(2-thienyl)-	74	10	24	9
568	28954	2H-1,3-Oxazine, 3-benzoyl-2-(2,6-dimethyl-5-heptenyl)tetrahydro-	48	---	---	---
569	70435	2H-1,3-Oxazine, 3-benzoyl-2-(2,6-dimethylheptyl)-tetrahydro-	39	---	---	---
570	28952	2H-1,3-Oxazine, 3-benzoyl-2-(1-ethylpentyl)-tetrahydro-	47	---	---	---
571	28948	2H-1,3-Oxazine, 3-benzoyltetrahydro-2-isopropyl-	20	10	27	10
572	28965	2H-1,3-Oxazine, 3-benzoyltetrahydro-2-(3-pyridyl)-	40	---	---	---
573	70175	Oxazolidine, 3-acetyl-2-butyl-2,4-diethyl-	5	2	---	0
574	70173	Oxazolidine, 3-acetyl-2-butyl-2-ethyl-	21	2	---	0
575	70335	Oxazolidine, 3-acetyl-2-(3-cyclohexen-1-yl)-	26	---	---	---
576	28963	Oxazolidine, 3-acetyl-2-(2,6-dimethyl-5-heptenyl)-	24	14	2	1
577	70143	Oxazolidine, 3-acetyl-2-(2,6-dimethyl-5-heptenyl)-4,4-dimethyl-	6	52	---	---
578	70146	Oxazolidine, 3-acetyl-2-(2,6-dimethyl-5-heptenyl)-4-ethyl-	14	48	---	---
579	70429	Oxazolidine, 3-acetyl-2-(2,6-dimethylheptyl)-	2	1	0	7
580	70431	Oxazolidine, 3-acetyl-2-(2,6-dimethylheptyl)-4,4-dimethyl-	18	28	---	---
581	70433	Oxazolidine, 3-acetyl-2-(2,6-dimethylheptyl)-4-ethyl-	30	---	---	---
582	28927	Oxazolidine, 3-acetyl-4,4-dimethyl-2-phenyl-	4	9	1	16
583	70138	Oxazolidine, 3-acetyl-4-ethyl-2-(1-ethylpentyl)-	4	13	---	0
584	28926	Oxazolidine, 3-acetyl-4-ethyl-2-isopentyl-2-methyl-	2	2	0	3
585	70177	Oxazolidine, 3-acetyl-4-ethyl-2-methyl-2-pentyl-	20	10	---	3
586	70140	Oxazolidine, 3-acetyl-2-(1-ethylpentyl)-	3	4	---	0
587	28929	Oxazolidine, 3-acetyl-4-ethyl-2-phenyl-	37	---	---	---
588	70197	Oxazolidine, 3-acetyl-2-(1-ethylpropyl)-4,4-dimethyl-	14	10	---	0
589	70407	Oxazolidine, 3-acetyl-2-(o-hydroxyphenyl)-, acetate	49	---	---	---
590	28867	Oxazolidine, 3-acetyl-2-isopentyl-2-methyl-	2	0	0	0
591	70149	Oxazolidine, 3-acetyl-2-isopentyl-2,4,4-trimethyl-	0	4	---	1
592	70195	Oxazolidine, 3-acetyl-2-isopropyl-4,4-dimethyl-	49	---	---	---
593	28928	Oxazolidine, 3-acetyl-2-[3,4-(methyleneedioxy)-phenyl]-	50	---	---	---
594	70139	Oxazolidine, 3-acetyl-2-(1-methylpentyl)-4,4-dimethyl-	8	5	---	8
595	28868	Oxazolidine, 3-acetyl-2-phenyl-	0	44	---	---
596	70413	Oxazolidine, 3-benzoyl-2-(2,6-dimethyl-5-heptenyl)-	33	---	---	---
597	70434	Oxazolidine, 3-benzoyl-2-(2,6-dimethyl-5-heptenyl)-4,4-dimethyl-	45	---	---	---
598	70432	Oxazolidine, 3-benzoyl-2-(2,6-dimethyl-5-heptenyl)-4-ethyl-	42	---	---	---
599	70437	Oxazolidine, 3-benzoyl-2-(2,6-dimethylheptyl)-	41	---	---	---
600	70436	Oxazolidine, 3-benzoyl-2-(2,6-dimethylheptyl)-4,4-dimethyl-	58	---	---	---

See footnotes at end of table.

TABLE 1.—Comparative effectiveness of synthetic and botanical compounds evaluated as repellents against 4 cockroach species—Continued

Item	(AI8- )	Compound	Cockroaches in treated carton <sup>1</sup>			
			German	American	Oriental	Brown-banded
SYNTHETICS—Continued						
601	28878	Oxazolidine, 3-benzoyl-4-ethyl-2-isopentyl-2-methyl-	55	---	---	---
602	70199	Oxazolidine, 3-benzoyl-4-ethyl-2-isopropyl-	12	38	---	---
603	28875	Oxazolidine, 3-benzoyl-2-ethyl-2-methyl-	4	2	2	29
604	28874	Oxazolidine, 3-benzoyl-2-isobutyl-2-methyl-	11	6	---	30
605	28869	Oxazolidine, 3-benzoyl-2-isopentyl-2-methyl-	32	---	---	---
606	70398	Oxazolidine, 3-benzoyl-2-isopropyl-	36	---	---	---
607	70196	Oxazolidine, 3-benzoyl-2-isopropyl-4,4-dimethyl-	10	6	---	0
608	28866	Oxazolidine, 3-benzoyl-2-phenyl-	84	50	---	---
609	28864	Oxazolidine, 3-butyl-2-phenyl-	62	---	---	---
610	70278	Oxazolidine, 3,4-diethyl-2-(1-ethylpentyl)-	16	50	---	---
611	70277	Oxazolidine, 3,4-diethyl-2-isopentyl-2-methyl-	46	---	---	---
612	70379	Oxazolidine, 3,4-diethyl-2-phenyl-	66	---	---	---
613	70378	Oxazolidine, 2-(2,6-dimethyl-5-heptenyl)-3,4-diethyl-	24	---	---	---
614	70307	Oxazolidine, 2-(2,6-dimethyl-5-heptenyl)-3-ethyl-	31	---	---	---
615	70380	Oxazolidine, 2-(2,6-dimethyl-5-heptenyl)-3-ethyl-4,4-dimethyl-	42	---	---	---
616	70337	Oxazolidine, 3-ethyl-4,4-dimethyl-2-phenyl-	24	24	---	---
617	70410	Oxazolidine, 3-ethyl-2-(1-ethylpentyl)-	40	---	---	---
618	70276	Oxazolidine, 3-ethyl-2-(1-ethylpentyl)-4,4-dimethyl-	34	---	---	---
619	70400	Oxazolidine, 3-ethyl-2-phenyl-	59	---	---	---
620	28638	2-Oxetanone, 4-pentyl-	18	0	2	1
621	34441	2-Pentenamide, 2-cyano- <i>N,N</i> ,3-triethyl-	2	0	---	---
622	34255	2-Pentenoic acid, 2-cyano-3,4-dimethyl-, methyl ester	30	---	---	---
623	33909	2-Pentenoic acid, 2-cyano-3-ethyl-	58	---	---	---
624	33827	2-Pentenoic acid, 2-cyano-3-ethyl-, methyl ester	28	---	---	---
625	34167	2-Pentenoic acid, 2-cyano-3-isopropyl-4-methyl-, methyl ester	40	---	---	---
626	15127	Pentylamine, <i>N</i> -[2-(2-butoxyethoxy)ethyl]-	52	53	---	---
627	25081	Peroxycarbamic acid, dimethyltrithio-, <i>tert</i> -butyl ester	2	4	---	---
628	17365	Phenol, 2-bromo-4- <i>tert</i> -butyl-, acetate	15	38	---	---
629	1122	Phenol, 2- <i>sec</i> -butyl-4,6-dinitro-	2	15	---	---
630	17248	Phenol, <i>o</i> -chloro-, acetate	58	52	---	---
631	3806	Phenol, <i>o</i> -chloro-, benzoate	50	45	---	---
632	17440	Phenol, <i>p</i> -( $\alpha,\alpha$ -dimethylbenzyl)-, <i>p</i> -toluenesulfonate	42	45	---	---
633	20008	Phenol, di- <i>tert</i> -pentyl, acetate	18	38	---	---
634	28073	Phenol, <i>p</i> -(methylthio)-	0	12	---	---
635	20826	Phosphonic acid, [3-(3,4-dimethoxyphenyl)-1-hydroxy-1-methylpropyl]-, dimethyl ester	38	37	---	---
636	20789	Phosphonic acid, (2,2,2-trichloro-1-hydroxyethyl)-, bis( <i>p</i> -chlorobenzyl) ester	48	46	---	---
637	27084	Phosphoramidothioic acid, diethyl-, cyclic <i>o,o</i> -(2,2-dimethyltrimethylene) ester	6	0	2	2
638	24679	Phosphorochloridothioic acid, <i>o,o</i> -dibutyl ester	57	50	---	---

See footnotes at end of table.

TABLE 1.—Comparative effectiveness of synthetic and botanical compounds evaluated as repellents against 4 cockroach species—Continued

Item	(AI3- )	Compound	Cockroaches in treated carton <sup>1</sup>			
			German	American	Oriental	Brown-banded
SYNTHETICS—Continued						
639---25864		Phosphorodithioic acid, <i>o</i> -ethyl <i>o</i> -propyl ester, <i>S</i> -ester with <i>N</i> -(mercaptomethyl) phthalimide	30	---	---	---
640---20596		Phthalamide, <i>N,N,N',N'</i> -tetraethyl-	45	---	---	---
641---2409		Phthalic acid	58	50	---	---
642---2617		Phthalimide, <i>N</i> -benzyl-	63	39	---	---
643---2418		Phthalimide, <i>N</i> -butyl-	20	15	---	---
644---2419		Phthalimide, <i>N</i> - <i>sec</i> -butyl-	30	3	5	20
645---2620		Phthalimide, <i>N</i> -cyclohexyl-	38	23	---	---
646---1394		Phthalimide, <i>N</i> -ethyl-	17	7	---	---
647---2422		Phthalimide, <i>N</i> -heptyl-	44	10	---	---
648---1397		Phthalimide, <i>N</i> -isobutyl-	17	18	---	---
649---1396		Phthalimide, <i>N</i> -isopropyl-	19	8	---	---
650---1393		Phthalimide, <i>N</i> -methyl-	4	24	---	---
651---2420		Phthalimide, <i>N</i> -(1-methylbutyl)-	40	22	---	---
652---2421		Phthalimide, <i>N</i> -(1-methylpentyl)-	30	21	---	---
653---2396		Phthalimide, <i>N</i> -octyl-	16	36	---	---
654---2417		Phthalimide, <i>N</i> -pentyl-	22	6	---	---
655---1395		Phthalimide, <i>N</i> -propyl-	16	1	---	---
656---26855		Phthalimide, <i>N</i> -[(1,1,2,2-tetrafluoroethyl)thio]-	0	---	---	---
657---28800		2-Pipecoline, 1-benzoyl-	0	0	---	---
658---35521		2-Pipecoline, 1-butyryl-	20	4	0	1
659---28980		2-Pipecoline, 1-( <i>o</i> -chlorobenzoyl)-	30	---	---	---
660---28987		2-Pipecoline, 1-( <i>p</i> -chlorobenzoyl)-	40	---	---	---
661---35761		2-Pipecoline, 1-(4-chlorobutyryl)-	60	20	14	36
662---35527		2-Pipecoline, 1-decanoyl-	22	60	---	---
663---35524		2-Pipecoline, 1-heptanoyl-	12	1	0	---
664---35523		2-Pipecoline, 1-hexanoyl-	5	1	0	0
665---35526		2-Pipecoline, 1-nanoyl-	20	52	---	---
666---35525		2-Pipecoline, 1-octanoyl-	24	43	---	---
667---28974		2-Pipecoline, 1- <i>o</i> -toluoyl-	38	---	---	---
668---28977		2-Pipecoline, 1- <i>p</i> -toluoyl-	36	---	---	---
669---35522		2-Pipecoline, 1-valeryl-	7	0	0	1
670---28989		3-Pipecoline, 1-benzoyl-	30	---	---	---
671---35613		3-Pipecoline, 1-butyryl-	0	0	0	1
672---28984		3-Pipecoline, 1-( <i>m</i> -chlorobenzoyl)-	7	3	8	2
673---28981		3-Pipecoline, 1-( <i>o</i> -chlorobenzoyl)-	48	---	---	---
674---28983		3-Pipecoline, 1-( <i>p</i> -chlorobenzoyl)-	57	---	---	---
675---35762		3-Pipecoline, 1-(4-chlorobutyryl)-	40	---	---	---
676---35619		3-Pipecoline, 1-decanoyl-	37	39	---	---
677---35616		3-Pipecoline, 1-heptanoyl-	0	2	0	0
678---35615		3-Pipecoline, 1-hexanoyl-	0	0	0	0
679---35618		3-Pipecoline, 1-nanoyl-	37	---	---	---
680---35617		3-Pipecoline, 1-octanoyl-	14	33	---	---
681---28975		3-Pipecoline, 1- <i>o</i> -toluoyl-	14	6	6	0
682---28978		3-Pipecoline, 1- <i>p</i> -toluoyl-	84	8	10	1
683---35614		3-Pipecoline, 1-valeryl-	2	4	0	0
684---28801		4-Pipecoline, 1-benzoyl-	10	5	---	---
685---35631		4-Pipecoline, 1-butyryl-	19	10	1	1

See footnotes at end of table.

TABLE 1.—Comparative effectiveness of synthetic and botanical compounds evaluated as repellents against 4 cockroach species—Continued

Item	(AI3- )	Compound	Cockroaches in treated carton <sup>1</sup>			
			German	American	Oriental	Brown-banded
SYNTHETICS—Continued						
			Percent	Percent	Percent	Percent
686---28985	4-Pipecoline, 1-( <i>m</i> -chlorobenzoyl)-		50	---	---	---
687---28982	4-Pipecoline, 1-( <i>o</i> -chlorobenzoyl)-		63	---	---	---
688---28986	4-Pipecoline, 1-( <i>p</i> -chlorobenzoyl)-		68	---	---	---
689---35763	4-Pipecoline, 1-(4-chlorobutyryl)-		36	---	---	---
690---35637	4-Pipecoline, 1-decanoyl-		42	---	---	---
691---35634	4-Pipecoline, 1-heptanoyl-		23	---	---	---
692---35633	4-Pipecoline, 1-hexanoyl-		11	1	0	0
693---35636	4-Pipecoline, 1-nonanoyl-		56	---	---	---
694---35635	4-Pipecoline, 1-octanoyl-		20	16	0	0
695---28976	4-Pipecoline, 1- <i>o</i> -toluoyl-		41	---	---	---
696---28979	4-Pipecoline, 1- <i>p</i> -toluoyl-		50	---	---	---
697---35632	4-Pipecoline, 1-valeryl-		10	2	0	0
698---70208	Piperazine, 1-(butylsulfonyl)-4-methyl-		60	---	---	---
699---35638	Piperazine, 1-heptanoyl-4-methyl-		48	---	---	---
700---35640	Piperazine, 1-methyl-4-nonanoyl-		15	29	23	16
701---35639	Piperazine, 1-methyl-4-octanoyl-		38	---	---	---
702---70370	Piperidine, 1-[2-(4-allyl-2-methoxyphenoxy)-ethyl]-		5	26	---	---
703---34288	Piperidine, 1-(butylsulfonyl)-		0	2	---	---
704---35468	Piperidine, 1-butyryl-		14	11	2	6
705---35648	Piperidine, 1-butyryl-2,6-dimethyl-		4	0	0	8
706---35641	Piperidine, 1-butyryl-2-ethyl-		12	2	1	4
707---23545	Piperidine, 1-(chloroacetyl)-		29	16	---	---
708---28988	Piperidine, 1-( <i>m</i> -chlorobenzoyl)-		68	---	---	---
709---35759	Piperidine, 1-(4-chlorobutyryl)-		30	---	---	---
710---35765	Piperidine, 1-(3-cyclohexen-1-ylcarbonyl)-		0	0	16	6
711---33511	Piperidine, 1-decanoyl-		36	---	---	---
712---35654	Piperidine, 1-decanoyl-2,6-dimethyl-		17	54	43	---
713---35647	Piperidine, 1-decanoyl-2-ethyl-		55	---	---	---
714---35653	Piperidine, 2,6-dimethyl-1-nonanoyl-		29	33	---	---
715---70339	Piperidine, 1-[2-[ (3,7-dimethyl-2,6-octadienyl)-oxy]ethyl]-		3	1	---	---
716---35652	Piperidine, 2,6-dimethyl-1-octanoyl-		49	5	0	1
717---28565	Piperidine, 2,6-dimethyl-1- <i>m</i> -toluoyl-		6	0	0	0
718---35649	Piperidine, 2,6-dimethyl-1-valeryl-		0	0	0	0
719---25921	Piperidine, 1-(2-ethylheptanoyl)-		3	---	---	---
720---35644	Piperidine, 2-ethyl-1-heptanoyl-		12	0	0	0
721---35643	Piperidine, 2-ethyl-1-hexanoyl-		8	0	0	0
722---35646	Piperidine, 2-ethyl-1-nonanoyl-		50	---	---	---
723---35645	Piperidine, 2-ethyl-1-octanoyl-		50	---	---	---
724---35642	Piperidine, 2-ethyl-1-valeryl-		1	0	1	0
725---33510	Piperidine, 1-heptanoyl-		2	1	0	0
726---35651	Piperidine, 1-heptanoyl-2,6-dimethyl-		8	0	0	0
727---32848	Piperidine, 1-hexanoyl-		0	0	0	0
728---35650	Piperidine, 1-hexanoyl-2,6-dimethyl-		0	0	0	0
729---70282	Piperidine, 1-[2-[2-(2-isobornylxyloxy) ethoxy]ethyl]-		15	12	---	---
730---34637	Piperidine, 1-[ (3-isopropyl-1-methylcyclopentyl)-carbonyl]-		0	10	0	2

See footnotes at end of table.

TABLE 1.—Comparative effectiveness of synthetic and botanical compounds evaluated as repellents against 4 cockroach species—Continued

Item	(AI8- )	Compound	Cockroaches in treated carton <sup>1</sup>			
			German	American	Oriental	Brown-banded
SYNTHETICS—Continued						
731	8009	Piperidine, 1-lauroyl-	38	---	---	---
732	35725	Piperidine, 1-[ (o-methoxyphenoxy) acetyl]-	62	---	---	---
733	35722	Piperidine, 1-[ (p-methoxyphenoxy) acetyl]-	48	---	---	---
734	35769	Piperidine, 1-[ (2-methylcyclohexyl) carbonyl]-	0	1	0	0
735	32828	Piperidine, 1-myristoyl-	38	---	---	---
736	32827	Piperidine, 1-nonanoyl-	1	32	---	---
737	32826	Piperidine, 1-octanoyl-	14	6	0	2
738	32850	Piperidine, 1-palmitoyl-	31	---	---	---
739	28563	Piperidine, 1- <i>m</i> -toluoyl-2-propyl-	34	23	---	---
740	28564	Piperidine, 1- <i>m</i> -toluoyl-4-propyl-	9	17	52	---
741	35516	Piperidine, 1-tridecanoyl-	32	---	---	---
742	35512	Piperidine, 1-undecanoyl-	19	30	---	---
743	35462	Piperidine, 1-valeryl-	2	0	0	0
744	35601	1-Piperidineethanol, acetate	37	---	---	---
745	28344	Piperonal, bis[2-(2-butoxyethoxy) ethyl] acetal (piproton)	60	---	---	---
746	20430	Piperonyl alcohol, $\alpha$ -(3-phenylpropyl)-	0	54	---	---
747	813	Piperonylamide, <i>N,N</i> -diethyl-	55	54	---	---
748	11319	1-Propanol, 3-(benzyloxy)-	27	14	---	---
749	70446	1-Propanol, 2-[ (3,7-dimethyloctyl) amino]-2-methyl-	0	1	2	1
750	70515	1-Propanol, 2-methyl-2-(octylamino)-	0	0	0	0
751	25029	2-Propanol, 1-(octylthio)-	33	---	---	---
752	2842	Propionamide, <i>N,N</i> -dibutyl-	22	39	---	---
753	2833	Propionamide, <i>N,N</i> -diethyl-	35	68	---	---
754	4253	Propionic acid, phenyl ester	39	50	---	---
755	2549	4 <i>H</i> -Pyran-4-one, 5-hydroxy-2-(hydroxymethyl)-	58	42	47	48
756	1240	Pyridine	52	---	---	---
757	70562	Pyridine, 1,2,3,6-tetrahydro-1- <i>m</i> -toluoyl-	8	---	---	---
758	17591	2,5-Pyridinedicarboxylic acid, dipropyl ester (MGK Repellent 326)	38	30	---	---
759	28870	Pyrrolidine, 1-benzoyl-	8	34	---	---
760	34289	Pyrrolidine, 1-(butylsulfonyl)-	3	1	---	---
761	35467	Pyrrolidine, 1-butyryl-	30	---	---	---
762	35695	Pyrrolidine, 1-butyryl-2,5-dimethyl-	29	---	---	---
763	35758	Pyrrolidine, 1-(4-chlorobutyryl)-	24	---	---	---
764	35764	Pyrrolidine, 1-(3-cyclohexen-1-ylcarbonyl)-	6	2	4	26
765	33517	Pyrrolidine, 1-decanoyl-	0	34	---	---
766	35698	Pyrrolidine, 2,5-dimethyl-1-octanoyl-	14	0	0	0
767	35696	Pyrrolidine, 2,5-dimethyl-1-valeryl-	0	0	2	2
768	33516	Pyrrolidine, 1-heptanoyl-	10	3	0	0
769	35697	Pyrrolidine, 1-heptanoyl-2,5-dimethyl-	2	1	0	0
770	32867	Pyrrolidine, 1-hexadecanoyl-	43	---	---	---
771	32852	Pyrrolidine, 1-hexanoyl-	2	0	0	6
772	32857	Pyrrolidine, 1-lauroyl-	24	---	---	---
773	35724	Pyrrolidine, 1-[ (o-methoxyphenoxy) acetyl]-	62	---	---	---
774	35721	Pyrrolidine, 1-[ (p-methoxyphenoxy) acetyl]-	30	---	---	---
775	35768	Pyrrolidine, 1-[ (2-methylcyclohexyl) carbonyl]-	0	0	0	2
776	32866	Pyrrolidine, 1-myristoyl-	13	46	---	---

See footnotes at end of table.

TABLE 1.—Comparative effectiveness of synthetic and botanical compounds evaluated as repellents against 4 cockroach species—Continued

Item	(AI3- )	Compound	Cockroaches in treated carton <sup>1</sup>			
			German	American	Oriental	Brown-banded
SYNTHETICS—Continued						
			Percent	Percent	Percent	Percent
777---32856	Pyrrolidine, 1-nonanoyl-		10	34	---	0
778---32853	Pyrrolidine, 1-octanoyl-		4	5	0	1
779---35515	Pyrrolidine, 1-tridecanoyl-		26	---	---	---
780---33518	Pyrrolidine, 1-undecanoyl-		19	34	---	---
781---35461	Pyrrolidine, 1-valeryl-		2	21	0	4
782---28015	1-Pyrrolidinebutyramide, 2-oxo-		56	---	---	---
783---35602	1-Pyrrolidineethanol, acetate		34	---	---	---
784---34290	Quinoline, 1-(butylsulfonyl)-1,2,3,4-tetrahydro-		31	54	---	---
785---31885	Salicylaldehyde, acetate		30	---	---	---
786---23189	Stearic acid, allyl ester		40	---	---	---
787---70549	Stearic acid, isopropenyl ester		30	---	---	---
788---23120	Stearic acid, vinyl ester		20	---	---	---
789---20934	Succinic acid, piperonyl-, dimethyl ester		62	65	---	---
790---31668	Succinimide, N-butyl-		2	4	---	---
791---25027	Sulfoxide, 3-chloropropyl octyl		12	61	---	---
792---35466	Tetradecanamide, N,N-dibutyl-		35	---	---	---
793---35465	Tetradecanamide, N,N-diethyl-		23	---	---	---
794---26662-X	Tetradecanamide, N,N-dimethyl- (95 percent), mixture with related amides (5 percent)		19	58	---	---
795---35512	Tetradecanamide, N,N-dipropyl-		11	64	---	---
796---28865	2,4,8,10-Tetraoxaspiro[5.5]undecane, 3,3,9,9-tetramethyl-		6	18	14	4
797---70405	Thiazolidine, 3-acetyl-2-(2,6-dimethyl-5-heptenyl)-		32	---	---	---
798---70404	Thiazoldine, 3-acetyl-2-(1-ethylpentyl)-		25	2	6	0
799---33253	Thiophene-3-ol, tetrahydro-, carbanilate, 1,1-dioxide		40	---	---	---
800---15485	Thymol, 2,6-dinitro-		1	28	---	---
801---26949	m-Toluamide, N,N-bis (2-cyanoethyl)-		30	---	---	---
802---20218	m-Toluamide, N,N-diethyl- (deet)		0	0	---	---
803---22542-X	m-Toluamide, N,N-diethyl- (75 percent), mixture with N,N-diethyl-p-toluamide (25 percent)		11	0	---	4
804---28950	m-Toluamide, N,N-diethyl-6-nitro-		60	16	64	42
805---70020	m-Toluamide, N,N-dihexyl-		36	---	---	---
806---30105	m-Toluamide, N,N-dimethyl-		4	0	---	---
807---70021	m-Toluamide, N-dodecyl-		38	---	---	---
808---70027	m-Toluamide, N-furfuryl-		48	---	---	---
809---70022	m-Toluamide, N-furfuryl-N-methyl-		17	26	14	19
810---70026	m-Toluamide, N-(2-methoxy-1-methylethyl)-		46	---	---	---
811---30131	m-Toluamide, N-methyl-		37	---	---	---
812---70047	o-Toluamide, N,N-dicyclohexyl-		54	---	---	---
813---20217	o-Toluamide, N,N-diethyl-		2	2	---	---
814---33470	o-Toluamide, N,N-diethyl- $\alpha,\alpha,\alpha$ -trifluoro-		16	2	---	---
815---70023	o-Toluamide, N,N-dihexyl-		42	---	---	---
816---70084	o-Toluamide, N,N-dipentyl-		46	---	---	---
817---70024	o-Toluamide, N-dodecyl-		53	---	---	---
818---70043	o-Toluamide, N-furfuryl-		32	---	---	---
819---70025	o-Toluamide, N-furfuryl-N-methyl-		21	---	---	---
820---70049	o-Toluamide, N-(2-methoxy-1-methylethyl)-		58	---	---	---

See footnotes at end of table.

TABLE 1.—Comparative effectiveness of synthetic and botanical compounds evaluated as repellents against 4 cockroach species—Continued

Item	(AI3- )	Compound	Cockroaches in treated carton <sup>1</sup>			
			German	American	Oriental	Brown-banded
SYNTHETICS—Continued						
			Percent	Percent	Percent	Percent
821----20219		<i>p</i> -Toluamide, <i>N,N</i> -diethyl-	0	0	---	---
822----34001		<i>p</i> -Toluamide, <i>N,N</i> -diethyl- <i>a,a,a</i> -trifluoro-	3	10	---	---
823----70029		<i>p</i> -Toluamide, <i>N,N</i> -dihexyl-	52	---	---	---
824----70030		<i>p</i> -Toluamide, <i>N</i> -dodecyl-	58	---	---	---
825----70050		<i>p</i> -Toluamide, <i>N</i> -furfuryl-	6	39	---	---
826----70046		<i>p</i> -Toluamide, <i>N</i> -furfuryl- <i>N</i> -methyl-	2	7	32	---
827----70028		<i>p</i> -Toluamide, <i>N</i> - (2-methoxy-1-methylethyl)-	43	---	---	---
828----70079		Toluene, 2,4,6-trimethoxy-	10	12	---	1
829---- 424		<i>p</i> -Toluenesulfonamide, <i>N,N</i> -dibutyl-	49	49	---	---
830---- 1885		<i>p</i> -Toluenesulfonamide, <i>N</i> -pentyl-	41	50	---	---
831---- 2555		<i>p</i> -Toluenesulfonic acid, octadecyl ester	32	---	---	---
832----35514		Tridecanamide, <i>N,N</i> -dibutyl-	48	---	---	---
833----35238		Tridecanamide, <i>N,N</i> -diethyl-	48	---	---	---
834----35513		Tridecanamide, <i>N,N</i> -dipropyl-	16	44	---	---
835----70355		Triethylamine, 2- (4-allyl-2-methoxyphenoxy)-	2	10	---	---
836----70447		Triethylamine, 2- [(decahydro-2-naphthyl) oxy]-	0	0	0	1
837----28546		Triethylamine, 2- [(3,7-dimethyl-2,6-octadienyl) thio]-, (E)-	10	0	2	0
838----70392		Triethylamine, 2- [(3,7-dimethyloctyl) oxy]-	0	1	---	---
839----70182-X		Triethylamine, 2- [3- (2-isobornylxyloxy) propoxy]-	2	6	---	---
840----70180		Triethylamine, 2- [4- ( <i>p</i> -menth-1-en-8-yl) butoxy]-	8	19	---	---
841----70280		Triethylamine, 2- [( <i>p</i> -menth-8-en-3-yl) oxy]-	0	10	---	---
842----70281		Triethylamine, 2- (9-octadecenylxyloxy)-	48	---	---	---
843----70179		Triethylamine, 2- (octadecyloxy)-	64	---	---	---
844----28545		Triethylamine, 2- (2-pinen-4-ylxyloxy)-	0	2	0	0
845----28544		Triethylamine, 2- (2(10)-pinen-3-ylxyloxy)-	0	0	0	0
846----35518		Undecanamide, <i>N,N</i> -dibutyl-	34	---	---	---
847----35236		Undecanamide, <i>N,N</i> -diethyl-	19	69	---	---
848----35235		Undecanamide, <i>N,N</i> -dipropyl-	24	---	---	---
849---- 2280		Undecanoic acid	35	36	---	---
850----33880		3-Undecanone, 4-methyl-	41	---	---	---
851---- 3928		10-Undecen-1-ol, acetate	4	---	---	---
852----70151		Urea, 3-isobornyl-1,1-dimethyl-	30	8	0	6
853----70152		Urea, 1-methoxy-1-methyl-3- [( <i>exo</i> -2-methyl-2-norbornyl)methyl]-	32	2	0	2
854----15401		Urea, phenyl-	34	---	---	---
855----35511		Valeramide, <i>N,N</i> -dibutyl-	1	0	0	0
856----35464		Valeramide, <i>N,N</i> -diethyl-	40	---	---	---
857----35706		Valeramide, <i>N,N</i> -diisobutyl-	7	2	0	1
858----35700		Valeramide, <i>N,N</i> -diisopropyl-	16	8	2	3
859----35710		Valeramide, <i>N,N</i> -dipentyl-	6	0	0	1
860----35510		Valeramide, <i>N,N</i> -dipropyl-	9	4	1	2
861----35716		Valeramide, <i>N</i> -hexyl-	3	6	1	0
862----35713		Valeramide, <i>N</i> -pentyl-	8	1	0	2
863----34256		Valeric acid, 2-cyano-3,4-dimethyl-, methyl ester	50	---	---	---
864----33911		Valeric acid, 2-cyano-3-ethyl-	42	---	---	---
865----33902		Valeric acid, 2-cyano-3-ethyl-, ethyl ester	18	3	0	0
866----33828		Valeric acid, 2-cyano-3-ethyl-, methyl ester	18	15	32	12

See footnotes at end of table.

TABLE 1.—Comparative effectiveness of synthetic and botanical compounds evaluated as repellents against 4 cockroach species—Continued

Item	(AI3- )	Compound	Cockroaches in treated carton <sup>1</sup>			
			German	American	Oriental	Brown-banded
SYNTHETICS—Continued						
			Percent	Percent	Percent	Percent
867---28502	Valeric acid, 2-methyl-, methyl ester		50	---	---	---
868--- 4161	Valeric acid, 4-methyl-		19	72	---	---
869---10517	Valerophenone, 4'-methoxy-		21	38	---	---
870---21035	<i>p</i> -Xylene- <i>a,a'</i> -diol, 2,3-dibromo-5,6-(methylenedioxy)-		57	38	---	---
871---33866	2,5-Xylenesulfonamide, <i>N,N</i> -diethyl-		50	---	---	---
872--- 8632	3,5-Xylenol, 4-chloro-		15	32	---	---
BOTANICALS						
873---25187-X	<i>Abies siberica</i> (Siberian pine needle oil)		15	---	---	---
874---41233	<i>Acacia farnesiana</i> , ethanol extract of leaves, stems		64	---	---	---
875---41268	<i>Acorus calamus</i> , distillation fraction of root oil 1		2	---	---	---
876---41269	<i>Acorus calamus</i> , distillation fraction of root oil 2		0	---	---	---
877---41235	<i>Aesculus octandra</i> , ethanol extract of leaves, stems		13	---	---	---
878---21302-X	Angelica seed oil		45	40	---	---
879---41243	<i>Aristolochia durior</i> , ethanol extract of leaves, stems		27	---	---	---
880---41252	<i>Baldwina uniflora</i> , ethanol extract of leaves, stems, roots, and flowers		30	---	---	---
881---41210	<i>Cinnamomum camphora</i> , ethanol extract of leaves		46	---	---	---
882---41262	<i>Elusine indica</i> , alcohol extract of leaves, stems, roots, and flowers		85	---	---	---
883---25396-X	<i>Ginkgo biloba</i> leaves, ethanol extractive		54	63	---	---
884---25395-X	<i>Ginkgo biloba</i> leaves, ethyl ether extractive		36	68	---	---
885---41202	<i>Heliotropium</i> sp., ethanol extract of leaves, stems		30	---	---	---
886--- 469	Juniper berry oil		8	---	---	---
887---41266	<i>Leandra clathrantha</i> , ethanol extract of leaves, stems		79	---	---	---
888---44652	<i>Melia azadirachta</i> , alcohol extract of fruit		53	---	---	---
889---44653	<i>Melia azadirachta</i> , ether-soluble portion of AI3-44652		20	32	---	---
890---44654	<i>Melia azadirachta</i> , solid from AI3-44653		60	---	---	---
891---32282	<i>Musa sapientum</i> var. <i>paradisiaca</i> , ethanol extract of banana pulp (aqueous solution)		52	---	---	---
892---41194	<i>Muscari racemosum</i>		10	25	36	68
893---41557	<i>Nepeta cataria</i> , ethanol extract		26	---	---	---
894---41556	<i>Nepeta cataria</i> , ether extract		20	35	---	---
895---41139	<i>Sassafras albidum</i> , ethyl ether extract (neutral fraction of leaves)		42	---	---	---
896---41206	<i>Schinopsis lorentii</i> , ethanol extract of leaves		64	---	---	---
897--- 123	<i>Schoenocaulon officinale</i> (sabadilla) (aqueous solution)		10	---	---	---
898---41176	<i>Umbellularia californica</i> , ethanol extract of leaves		50	---	---	---
899---41178	<i>Umbellularia californica</i> , ethanol extract of stems, roots		26	---	---	---
900---41175	<i>Umbellularia californica</i> , ethyl ether extract of leaves		26	---	---	---
901---41177	<i>Umbellularia californica</i> , ethyl ether extract of stems, roots		8	---	---	---

<sup>1</sup> Percentages can be converted to percent repellency by multiplying them by 2 and subtracting from 100.<sup>2</sup> 151, 80, 46, and 48 tests, respectively, for German, American, oriental, and brownbanded cockroaches.

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63	308	3928	851	15129	291	18524	119
85	508	4161	868	15130	290	18525	120
106	505	4162	543	15136	424	18526	124
112	474	4253	754	15266	503	20008	633
123	897	4368	221	15267	224	20217	813
301	385	4370	241	15311	470	20218	802
424	829	4453	355	15354	150	20219	821
469	886	4910	436	15401	854	20221	329
751	396	4914	454	15485	800	20299	184
813	747	4919	315	15687	143	20317	313
898	267	4922	320	15800	511	20332	336
1000	526	4923	331	15826	514	20367	333
1019	376	5014	382	15831	510	20429	339
1029	138	5519	277	15833	509	20430	746
1088	96	5523	105	15834	513	20438	338
1122	629	5528	107	15843	530	20439	337
1197	225	5533	371	15844	529	20453	340
1240	756	5756	275	16106	472	20549	481
1393	650	5780	292	16275	344	20596	640
1394	646	5816	109	16500	397	20768	399
1395	655	5831	134	16634	264	20789	636
1396	649	5844	276	16737	48	20803	278
1397	648	6147	285	16742	45	20810	155
1643	479	6217	467	17248	630	20826	635
1885	830	6381	373	17307	106	20886	346
2069	181	6535	328	17365	628	20888	341
2133	325	7174	319	17434	469	20934	789
2185	375	7407	400	17440	632	21035	870
2280	849	7701	435	17591	758	21125	272
2396	653	7799	395	17596	362	21274	1
2409	641	8006	425	18013	363	21296	113
2417	654	8009	731	18274	500	21302-X	878
2418	643	8184	525	18278	484	21482	347
2419	644	8448	236	18284	498	21505	293
2420	651	8632	872	18285	487	21675	298
2421	652	9004	365	18343	114	21699	146
2422	647	9005	364	18405	131	21732	147
2484	94	9214	359	18407	132	22212	431
2549	755	9480	282	18409	118	22213	430
2555	831	10517	869	18412	117	22542	803
2617	642	10525	312	18414	125	22879	428
2620	645	10548	144	18416	116	23120	788
2812	381	11010	476	18417	115	23189	786
2832	91	11064	296	18420	287	23388	5
2833	753	11319	748	18484	127	23390	38
2842	752	12010	321	18486	284	23527	26
2844	482	12099	507	18487	129	23528	6
2954	295	14147	194	18489	288	23529	29
3130	473	14244	324	18493	289	23530	2
3295-X	527	14249	335	18495	130	23531	19
3341	108	14640	149	18498	122	23532	27
3395	384	14753	201	18499	123	23533	28
3662	394	14755	217	18500	133	23534	139
3710	271	15029	368	18503	126	23535	24
3806	631	15069	512	18522	128	23536	140
3809	273	15127	626	18523	121	23537	35

AI3-	Item	AI3-	Item	AI3-	Item	AI3-	Item
23538	103	27195	499	28971	216	33253	799
23539	102	27196	489	28972	189	33264	300
23540	104	27197	493	28973	188	33336	461
23541	93	27198	483	28974	667	33421	223
23542	23	27199	357	28975	681	33422	222
23543	51	27662	342	28976	695	33448	235
23544	22	28015	782	28977	668	33450	233
23545	707	28073	634	28978	682	33451	214
23546	486	28074	314	28979	696	33461	230
23547	50	28094-X	465	28980	659	33462	227
23548	99	28344	745	28981	673	33464	182
23549	97	28464	135	28982	687	33465	195
23550	95	28502	867	28983	674	33466	196
23551	25	28544	845	28984	672	33470	814
23552	32	28545	844	28985	686	33476	463
23553	111	28546	837	28986	688	33480	89
23554	112	28563	739	28987	660	33481	90
23558	30	28564	740	28988	708	33484	58
23559	101	28565	717	28989	670	33485	59
23560	98	28637	504	30105	806	33486	84
23561	110	28638	620	30131	811	33487	85
23562	37	28726	229	30682	343	33488	54
23563	100	28739	226	31012	345	33489	55
23564	36	28800	657	31056	535	33491	65
23565	33	28801	684	31066	540	33492	62
23566	136	28864	609	31072	534	33493	63
23569	159	28865	796	31081	533	33497	74
23570	21	28866	608	31416	283	33498	72
23571	34	28867	590	31544	307	33499	73
23573	7	28868	595	31668	790	33501	88
23574	31	28869	605	31885	785	33502	86
23575	137	28870	759	32282	891	33503	87
23583	20	28874	604	32806	165	33505	49
24292	506	28875	603	32807	169	33506	82
24649	449	28876	553	32826	737	33507	83
24679	638	28877	566	32827	736	33510	725
24828	386	28878	601	32828	735	33511	711
25027	791	28926	584	32838	176	33512	742
25029	751	28927	582	32839	175	33513	166
25031	627	28928	593	32840	170	33514	164
25187-X	873	28929	587	32841	174	33515	179
25215	326	28930	550	32848	727	33516	768
25362	374	28948	571	32849	167	33517	765
25395-X	884	28949	565	32850	738	33518	780
25396-X	883	28950	804	32851	177	33826	447
25864	639	28951	563	32852	771	33827	624
25920	408	28952	570	32853	778	33828	866
25921	719	28953	561	32856	777	33829	419
26660	533	28954	568	32857	772	33830	412
26661-X	377	28962	185	32866	776	33831	547
26662-X	794	28963	576	32867	770	33832	524
26664	148	28964	567	32960	294	33833	546
26855	656	28965	572	33158	303	33834	521
26936	434	28966	10	33176	301	33862	153
26941	310	28967	43	33210	305	33863	152
26949	801	28968	13	33221	306	33866	871
27084	637	28969	16	33223	304	33867	266
27194	501	28970	47	33249	316	33868	456

AI3-	Item	AI3-	Item	AI3-	Item	AI3-	Item
33869	451	34252	448	35466	792	35655	485
33870	421	34253	446	35467	761	35656	492
33871	452	34255	622	35468	704	35657	497
33872	422	34256	863	35469	161	35658	495
33873	458	34283	334	35509	406	35659	491
33874	437	34284	332	35510	860	35660	490
33875	415	34288	703	35511	855	35661	488
33876	414	34289	760	35512	795	35667	502
33877	358	34290	784	35513	834	35668	496
33878	523	34291	471	35514	832	35669	494
33879	379	34292	280	35515	779	35695	762
33880	850	34293	281	35516	741	35696	767
33899	330	34294	279	35517	178	35697	769
33900	477	34440	450	35518	846	35698	766
33901	445	34441	621	35519	426	35700	858
33902	865	34446	417	35520	427	35701	404
33908	459	34447	410	35521	658	35702	537
33909	623	34456	231	35522	669	35703	518
33910	443	34457	154	35523	664	35704	352
33911	864	34458	423	35524	663	35705	286
34001	822	34459	151	35525	666	35706	857
34002	297	34460	245	35526	665	35707	403
34050	57	34461	299	35527	662	35708	536
34051	53	34467	234	35583	383	35709	517
34052	61	34468	232	35601	744	35710	859
34053	64	34469	243	35602	783	35711	405
34075	274	34470	242	35604	388	35712	539
34107	79	34471	244	35613	671	35713	862
34108	56	34472	257	35614	683	35714	407
34109	52	34473	256	35615	678	35715	542
34110	78	34474	258	35616	677	35716	861
34111	60	34475	219	35617	680	35717	541
34121	270	34476	218	35618	679	35721	774
34122	268	34477	220	35619	676	35722	733
34123	269	34478	239	35631	685	35723	172
34152	478	34479	238	35632	697	35724	773
34167	625	34480	240	35633	692	35725	732
34169	464	34636	168	35634	691	35726	171
34172	462	34637	730	35635	694	35758	763
34178	380	34697	351	35636	693	35759	709
34191	460	34698	516	35637	690	35760	162
34192	420	34960	353	35638	699	35761	661
34193	418	35231	519	35639	701	35762	675
34194	416	35232	515	35640	700	35763	689
34203	39	35233	354	35641	706	35764	764
34206	457	35234	350	35642	724	35765	710
34207	455	35235	848	35643	721	35766	163
34208	453	35236	847	35644	720	35767	327
34234	156	35237	378	35645	723	35768	775
34243	409	35238	833	35646	722	35769	734
34244	413	35458	429	35647	713	35770	173
34245	411	35459	402	35648	705	35771	322
34246	438	35460	401	35649	718	41139	895
34247	441	35461	781	35650	728	41175	900
34248	442	35462	743	35651	726	41176	898
34249	440	35463	180	35652	716	41177	901
34250	439	35464	856	35653	714	41178	899
34251	444	35465	793	35654	712	41202	885

AI3-	Item	AI3-	Item	AI3-	Item	AI3-	Item
41206	896	70045	191	70176	4	70336	40
41210	881	70046	826	70177	585	70337	616
41233	874	70047	812	70179	843	70339	715
41235	877	70048	210	70180	840	70355	835
41243	879	70049	820	70181	366	70370	702
41252	880	70050	825	70182-X	839	70378	613
41262	882	70051	193	70193	389	70379	612
41266	887	70052	309	70194	261	70380	615
41268	875	70053	302	70195	592	70381	77
41269	876	70054	311	70196	607	70392	838
41556	894	70056	433	70197	588	70398	606
41557	893	70057	520	70198	564	70399	556
41994	892	70058	544	70199	602	70400	619
44652	888	70059	475	70200	265	70401	392
44653	889	70078	260	70201	68	70402	372
44654	890	70079	828	70202	76	70403	370
70006	252	70080	158	70203	254	70404	798
70007	255	70081	157	70204	253	70405	797
70008	183	70082	263	70208	698	70406	391
70009	237	70083	387	70209	160	70407	589
70010	247	70084	816	70234	17	70408	393
70011	249	70085	199	70235	67	70409	66
70012	248	70086	246	70236	69	70410	617
70013	211	70087	323	70237	15	70411	186
70014	190	70088	390	70238	71	70412	215
70015	197	70089	545	70239	81	70413	596
70016	200	70090	398	70240	80	70414	369
70017	202	70091	356	70271	46	70415	70
70018	208	70092	480	70272	14	70429	579
70019	205	70093	228	70273	250	70430	562
70020	805	70094	262	70274	3	70431	580
70021	807	70138	583	70275	251	70432	598
70022	809	70139	594	70276	618	70433	581
70023	815	70140	586	70277	611	70434	597
70024	817	70141	44	70278	610	70435	569
70025	819	70142	548	70279	554	70436	600
70026	810	70143	577	70280	841	70437	599
70027	808	70144	560	70281	842	70446	749
70028	827	70145	11	70282	729	70447	836
70029	823	70146	578	70283	367	70483	522
70030	824	70147	549	70306	92	70515	750
70031	212	70148	9	70307	614	70523	531
70032	203	70149	591	70308	187	70541	360
70035	532	70151	852	70310	318	70542	361
70036	12	70152	853	70311	317	70543	349
70037	213	70160	432	70322	8	70544	348
70038	198	70169	555	70329	41	70545	142
70039	204	70170	558	70330	18	70546	141
70040	207	70171	559	70331	551	70547	468
70041	206	70172	557	70332	552	70548	528
70042	209	70173	574	70333	75	70549	787
70043	818	70174	259	70334	42	70550	145
70044	192	70175	573	70335	575	70551	466
						70562	757



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